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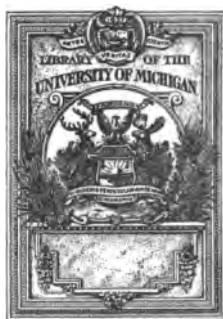
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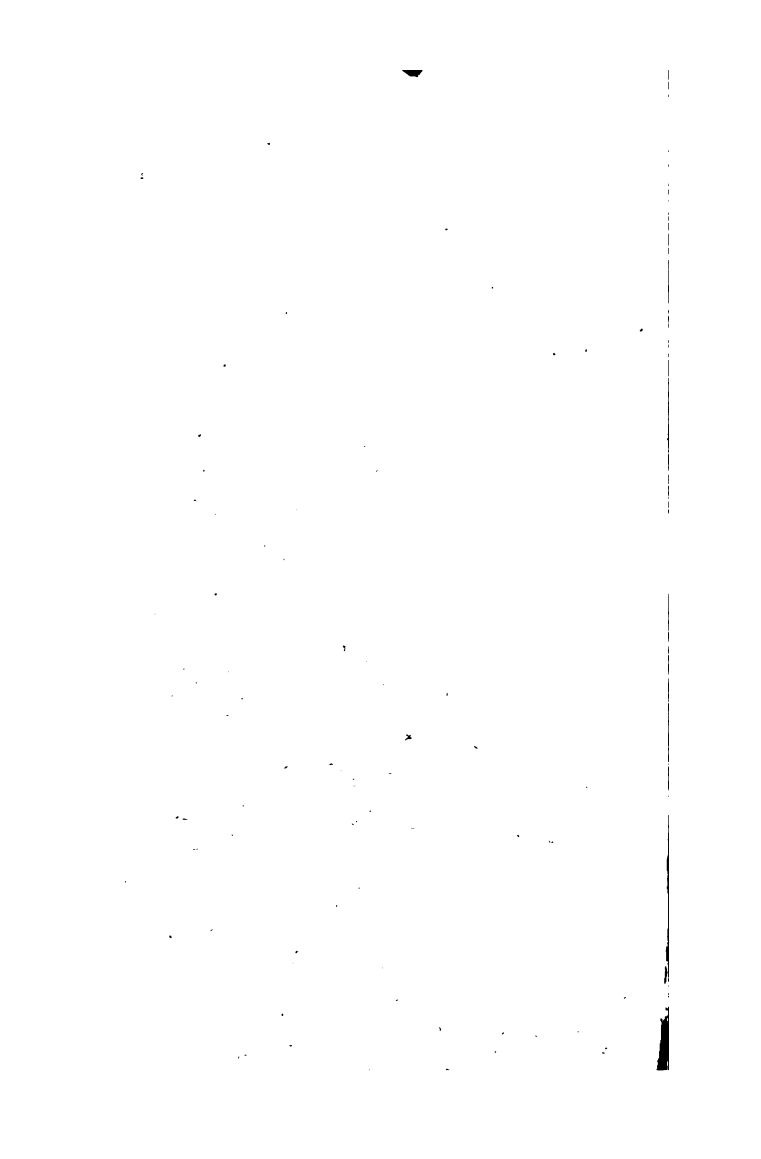


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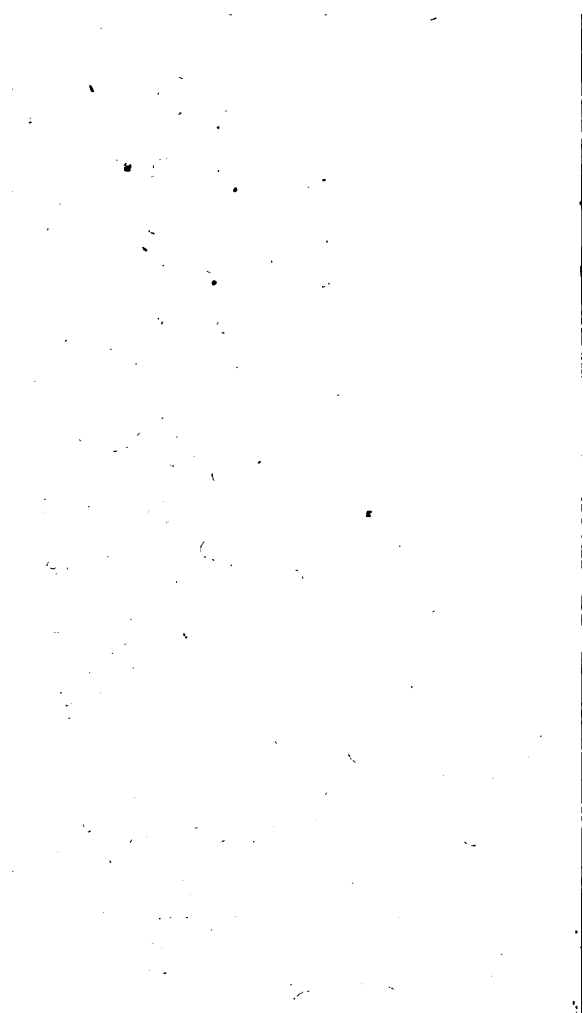
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# DEVELOPMENT.

BY ALFRED WATKINS.

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1904.

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# DEVELOPMENT.

## CHAPTER I.

26  
36  
12  
The editor tells me that I had better write as if I were instructing some one who knows nothing at all about the subject. Now, the difficulty is that most of my readers *do* know something, and that they have probably formed a mental picture of what development is and how it proceeds, which mental picture (from no fault of theirs) is so entirely wrong and so much at variance with what I have to say that it will be a serious obstacle to their even listening to me.

26  
Let me therefore ask that for the time the old mental picture of the process be put on one side and that you, my keen-witted reader (for the sooner I address you personally, the better), are at least ready to follow my mental picture of what development is and how we can best control it.

## THE PROBLEM.

You want to secure a photograph in which the lights and shades on the final bit of paper shall accurately reproduce the lights and shades of the subject before the lens. Take up any print or photograph and you will find an example of what your subject might be. There is every gradation between black and white in the picture, so blended together and so broken up into small fragments that it is difficult to say "Here is a patch of full black, here a dark tone, here a light tone, and here full light or white." So to simplify matters I put before you an exceedingly simple subject in which only four tones occur, and there are good, broad patches of each of them.

It is a pyramid of wood painted white (Fig. 1), and seen against a background of black flock paper. And yet it does not appear all white. The light shines from the side, and one side only is represented by pure white. The farther side is in fairly deep shadow, and the front face is an intermediate tone, while the background is so black that it reflects no light at all to the lens. Now



FIG. 1.

if I were on another subject, what a sermon on lighting I could preach on this simple block of wood, all white and

yet presenting three distinct tones. But I must keep to my point, and it is that in every subject you may want to photograph there is a range of different tones, sometimes produced by the lighting, sometimes by the color of the objects, and that the four tones in the simple little picture before us may be taken to represent them. You have probably thought of the tones in a photograph as undefined and blending into each other, but let me ask you to keep this picture in your mind and think of the different tones between white and black as well defined and distinct *steps* in the scale of gradation.

But we have only touched the first point in our problem and can not yet even go on to consider the finished photograph. To produce on paper a facsimile of the tones and lights and shades of the original subject you must first secure a record (on transparent glass or film) of the amount and position of all these tones.

The plate or film on which this record is to be made is called the sensitive plate, and the record when finished we call a negative. To make this record it is necessary that the various amounts of

light reflected from the objects being photographed should be impressed upon the sensitive plate (which is shut up in a dark box, the camera), by passing through a lens. It is also necessary that these rays of light should be allowed to fall upon the sensitive plate for enough time to have the required effect and yet not enough time to overdo and spoil the effect. This branch of photography is called exposure; it is a subject which I am not writing upon in these articles, and I have to presume that a sufficiently correct exposure has been given to the plate.

I have not yet described what the sensitive plate looks like or is. By the way, although in kodaks and other cameras a celluloid film is used instead of a glass plate as a support to the sensitive surface, it will be more convenient to always use the word plate, as the surface itself is sometimes called the film. Well, the plate, to look at, has a cream-colored surface and is about as transparent as thin china. It has exactly the same appearance after exposure as it had before, and a microscopic examination could not detect a difference. To make this sensitive surface, a kind of

soup has been prepared, with a mixture of gelatin (dissolved in water) and innumerable particles of a silver salt called bromide of silver. This soup has been poured on the glass plate (or film) and allowed to set, first into a substantial thickness of jelly and later into a skin or layer on the plate. It is the sand-like particles of bromide of silver which become acted upon by the light, and the action of the developer is to alter those particles affected by light to the black or metallic state, and to leave those particles unaffected by light in the transparent state, so that they can afterward be dissolved away by a chemical solution called the fixing bath.

#### THE MENTAL PICTURE.

Banish from your mind your old mental picture of a sensitive *surface* to the plate, and think of it as a substantial thickness of jelly in which are embedded innumerable sensitive particles, each one separately ready to be acted upon by light so as to be put into the developable condition. Fig. 2 is an imaginary section or slice through the sensitive film showing the sensitive particles much exaggerated in size. Suppose

that on the part of the plate marked A no light has fallen and none of the particles are affected; that on the part marked D a full amount of light has fallen (such as that reflected from the lightest side of our wooden pyramid), and that therefore all the particles are

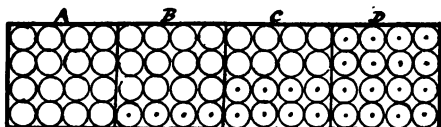


FIG 2

affected, this action being marked by a dot on each. In the part of the film marked C, half the particles are supposed to have been affected by the light, and in B one quarter, all so affected being marked by a dot.

Now, our ultimate aim or result (as far as these articles are concerned) is the finished record or negative of which I have spoken. Let us see what this is like. Glance again at our wooden pyramid (Fig. 1), and then at Fig. 3, which is its record or negative. A sensitive plate has been exposed to the rays of light reflected from our pyramid and fully developed. At the part marked A,



where the black background is represented, no light has fallen, and no particles were affected, and so clear glass remains. At D the full light from the whitest side fell, all the silver particles were changed to the developable condition and all were reduced to blackness and opacity. C and D are (as in Fig. 2) intermediate light actions, and therefore intermediate tones. Now, if you will compare Fig. 1 with Fig. 3 you will find they are exactly the opposite of each other. Where one is black the other is white, and vice versa, and the first is often called the *positive*, while the other (which I have termed the record) is nearly always known as the *negative* representation of the object.

Now that we know what it is we are going to try to produce (the negative), let us come back to our mental picture of the thickness of the film. You have looked at Fig. 2 and noted those particles which are marked with a dot and are therefore in a developable condition. Never mind for the present what a developer consists of. It is sufficient to know that it is a chemical solution which, when poured on the exposed sensitive plate, has the power of gradually

## DEVELOPMENT.

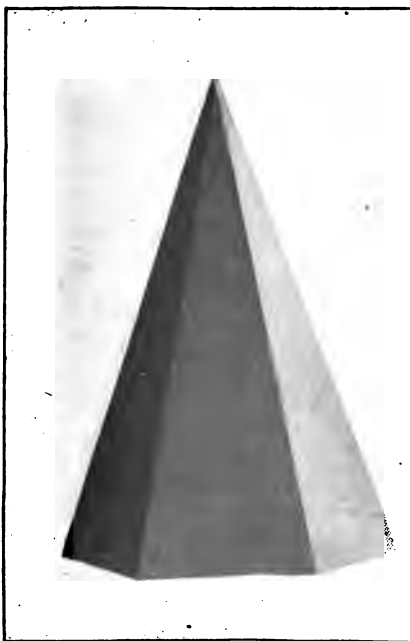


FIG. 3.

altering those particles affected by li  
to the black and opaque condition. '  
developer has been poured on our p

and has been allowed to act for one-quarter the time required for its full effect. In Fig. 4 we get a graphic rep-

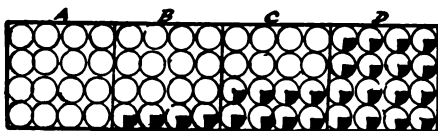


FIG 4

resentation of what takes place. One-quarter of the dotted particles are blackened and one-quarter of the developing work is done, it being particularly to be noted that the developer has done just the same *proportion* of work on B

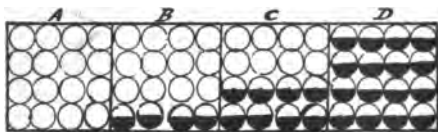


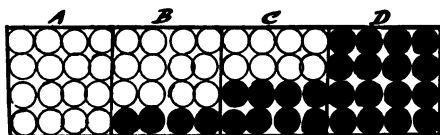
FIG 5

as on D on the particles which were ready for it to act on.

Fig. 5 shows what the developer may be supposed to have done at half time, when it has only half got through its

work. The affected particles are now all half blackened.

In Fig. 6 we see the result when the developer has completed its work. All the silver particles which the light has affected are now fully blackened. You will notice that at all stages (Figs. 4, 5 and 6) those particles not dotted are not touched at all by the developer. If, however, we left the plate too long in



*FIG 6*

the developer it would begin to darken even these particles (a result which is generally known as fog), and in time darken the whole plate throughout, a thing, of course, to be avoided.

Now, if you were to hold up the plates represented by Figs. 4, 5 and 6 to the light the first would show a feeble darkening in each of the three gradations, with little contrast between them, the second a much stronger darkening and more contrast, while in the third the

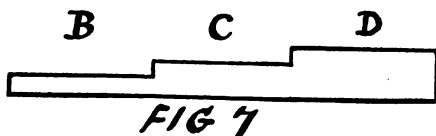
darkest tone is absolutely opaque and there is a very strong contrast between that and the faintest tone (B) on the same plate. In fact, the tone D has *increased in opacity much more rapidly than the tone B.*

## CHAPTER II.

This fact is so important as the true foundation of any correct idea of development that I feel bound to try to engrave it upon your memory by means of

## ANOTHER MENTAL PICTURE.

I have compared the different tones or darknesses in a negative to steps. Let us imagine that a father wishes to educate his baby boy (who can just toddle) in walking up and down stairs; and that out in the yard the mason has built a tiny flight of three steps, each with an equal shallow rise just suitable for the baby feet, as you will see in Fig. 7. A



year or so passes; the father wishes to continue the training, but the steps are now too shallow, and the mason is

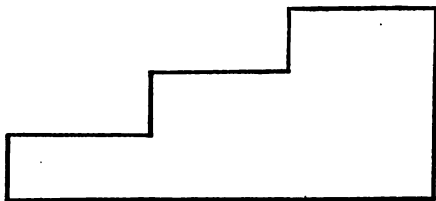
called in to add to them, but in such a way that the rise of each step shall still be equal. Fig. 8 is the result, the steps being steeper than before. As time goes on these are not steep enough to complete the stair-climbing education of our little friend, and again the mason is called in. He wants to build a new flight of steps, but he is made to add to those already existing on the same



**FIG 8**

ground space, and the steeper flight of steps shown in Fig. 9 is the result. Notice the increase of steepness as the steps are added to. Notice also that the mason has to add much more thickness to D than he has to B when he is called upon to increase the inclination of the steps. The process of development runs exactly on these lines. As development proceeds, the various tones are "built up." The building-up process does not consist of adding the same

amount of deposit on each tone, nor, on the other hand, is the deposit only on the



*FIG 9.*

darker tones, but a definite proportion is added to each, and the steepness of gradation increases (as you will see by looking at the figures) as development proceeds. Broadly speaking, no alteration of the developer gives the power of adding to certain steps and not adding to others; they are *all* added to as development proceeds, but still the steepness increases until what is called "fog" commences and then the lower steps begin to fill up.

It is constantly presumed by writers that one developer has a tendency to add to the higher steps, neglecting the lower ones; while another class of developers pays most attention to the



lowest steps and does not do so much to the upper ones. This is quite false; all varieties of developer (after they have well started to work) do a definite proportion of work on *all* the steps of gradation, this proportion being decided by the exposure.

I do not think that I have explained the naming of the tones. It should be kept in mind that the tones (or steps of gradation) are named from their appearance in the *positive*, and that these names are not altered when the same tone is recorded in the negative. Thus in Fig. 1 the tone marked D is called the "high light" because it is the lightest tone in the picture, C and B are "half-tones," and the background is the deepest tone or shadow. As a rule, the shadow is not all equally black, and therefore "deep" or "low" tones are called "shadow detail."

When we come to the negative (Fig. 3), although D is the blackest tone *it is still called the "high light"*; and although the deepest or shadow tone is now clear glass (or almost so), it is still called by the old name.

## STAGES OF CONTRAST.

In Fig. 10 you will see the negative image of our white pyramid as it appears at three stages of development. A metol-hydroquinone developer (you will know what this means later on) was applied to the exposed plate, and the image appeared in half a minute. X was taken out and fixed at twice this time (one minute from pouring on). Y was a similar exposure taken out at four times the appearance (two minutes), and Z at seven times the appearance of the image — that is, three and a half minutes. Perhaps we had better halt here and consider what the negative is required for. It is not in itself a finished photograph, but has to be put in a printing-frame with a piece of sensitive paper behind it, and exposed to daylight. If there is *sufficient contrast* between B, C and D we shall get a "print" (as the paper photograph is called) having the full amount of contrast, as shown in Fig. 1. But if we were to use the thin negative shown in No. X of Fig. 10 (the one taken out at an earlier stage of development) we should get a flat gray print with very little con-

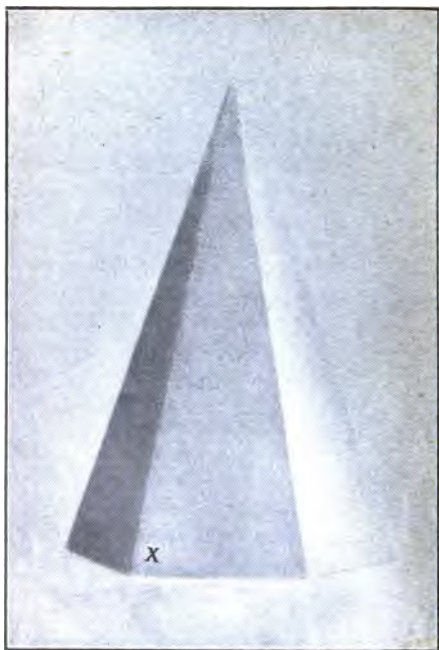


FIG. 10, X.

trast between the tones. A print from No. Y would be better, while one from No. Z would probably give what is

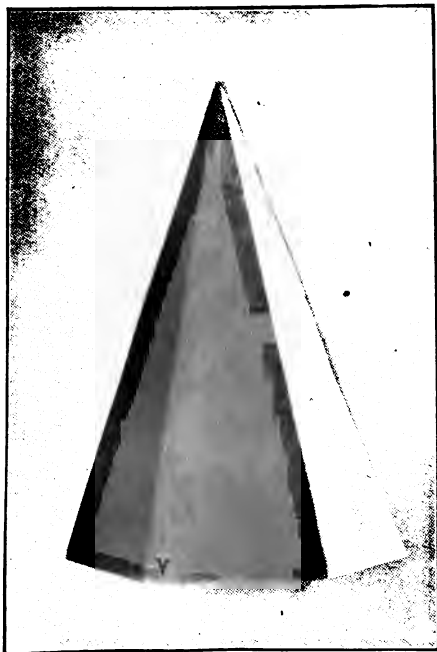


FIG. 10, Y.

wanted — the right amount of contrast between the tones. It is possible to develop so far that there is *too much*

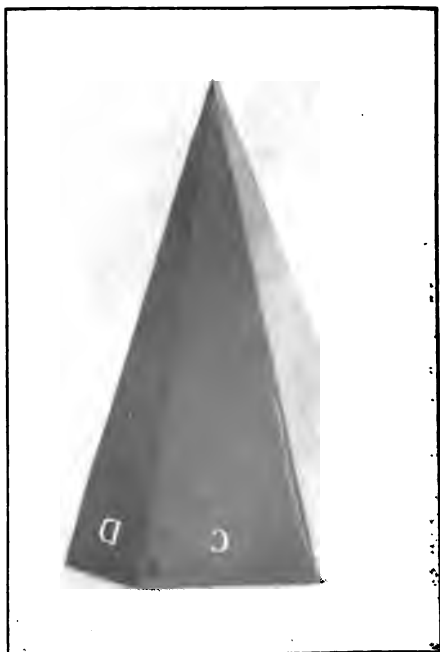


FIG. 10, Z.

contrast, in which case both C and D would have very dense deposits on the negative which would not print through

and be represented by white paper in the positive or print. This defect of overdevelopment gives a snowy or "soot and whitewash" effect in the finished print.

I can not too forcibly put before you that the chief question in development is a

#### QUESTION OF CONTRAST,

and that this can usually be secured by regulating the time the developer is allowed to act.

I must point out, by the way, that Fig. 10 must be taken as merely illustrative. A really vigorous printing negative is much denser in all its gradations than appears in No. Z, but it is difficult to show how dense on a half-tone block.

## CHAPTER III.

You will probably think that I am hammering in too forcibly this question of length of development regulating the contrast in the negative, but I am convinced that in the first place it constitutes the most important part of the "science of development;" and in the second place it has been totally ignored by former teachers.

To illustrate this I may mention that in 1896 I examined all the instructions issued by platemakers in England and America, twenty-four in number; thirteen of them made no reference of any kind to length of development, and the remaining eleven such slight references as "Develop after the tones are out;" "Develop until you can see the image at the back;" or, "Develop until you think it is dense enough." Not a single one made any reference, direct or indirect, to the fact that length of development increases contrast, although it is a means of control which is applicable to

every possible developer, and every formula. The reason for this apparent neglect lies in the peculiar nature of pyro as a developer, which I shall refer to later on. If dry-plate development had just been worked out with one of the simpler modern developers the rule which I expound would have been laid down long ago.

In Fig. 11 I illustrate the alteration in contrast which is secured by different times of development with an ordinary outdoor subject. The first print is from a negative taken out of the developer at an early stage, only three and one-half times the appearance of the image (you will have this explained later on) and the result is a thin negative of insufficient contrast.

The second negative was left in longer (five times appearance) and the contrast between the tones is about sufficient. The third negative, developed for eight times appearance, has a forced unnatural contrast between the tones which reproduction has rather toned down. In the original there is a wiry knife-edge kind of look which is not desirable in a photograph; had it been another subject it might have been



summed up in the familiar phrase "soot and whitewash."

#### LIMITS OF THE RULE.

You must clearly understand that it is only within certain limits that the rule of increasing contrast holds good.



FIG. 11a.—Factor  $3\frac{1}{2}$ .

When the developer has fully altered all the silver particles which form the high lights, increase of contrast ceases. This you will see by looking at Figs. 7, 8 and 9 in my previous article. When the top step is as tall as the thickness

of the film permits it is of course impossible to further increase the steepness of the flight of steps. With slow landscape plates the top step can be made taller, and the inclination of the whole series of steps steeper, than you are likely to want, and care has therefore to be taken not to overdevelop. But there are some plates with which it seems impossible to attain more than a very moderate amount of steepness, they are usually (but not always) fast plates.

There is another entirely distinct limit. I have explained that when the particles unaffected by light and darkened by the developer such darkening is called fog. With some plates the fogging action commences at quite an early stage of development, and I think it may be taken as a general rule that when fog sets in, all increase of contrast in the negative ceases. The reason for this will be seen by referring to Fig. 2, where it will be seen that there are most unaffected particles for fog to act upon in the lowest step. The addition of fog is a leveling-up process.

## DEFINITIONS.

Let me here edge in a couple of definitions. When I speak of different developers I mean different developing agents — such as pyro, metol, etc.— not merely different formulæ. When I speak of strength of developer I refer to grains of developing agent to the ounce, not merely changes in alkali.

## FOG.

Perhaps I had better say a little about this somewhat undesirable agent — although sometimes it is usefully employed by skilled photographers.

My experiments indicate that it appertains far more to the plate than to the developer. In trials with six developers (all with equal amounts of alkali and no bromide) fog commenced at exactly the same stage of contrast with each. This trial indicated that it is simply untrue to say that one developer has less tendency to fog than another, when used in a similar state of energy. In each case it continued to increase with length of development and would only cease when it had filled up all the lower tones or steps, or in

other words, had uniformly darkened the film throughout. Probably temperature has much to do with fog, but I have not investigated this point. The use of bromide in the developer only holds



FIG. 11*b*.—Factor 5.

it back for a time, and if that time is exceeded it appears vigorously.

#### HOW DEVELOPERS VARY.

You will soon find that I am no believer in the fetish of formulæ, or in the much advertised superiority of one developer over another.

In a paper read before the Royal Photographic Society I described a comparison of seven developers, namely, pyro, metol, ortol, adurol, hydroquinone, kachin and glycin. All were made up with the same formula (no bromide) and compared under the same circumstances. The result may be summed up:

Effect on speed of plate, very slight and doubtful differences.

Searching out detail, no difference.

Fogging propensity, no difference.

Ultimate density power, no difference.

Appearance of image, wide difference.

Speed of working, wide difference.

There is one respect in which developers differ. One class of developers (represented by metol, rodinal and weak pyro) causes all the tones to appear very early in the course of development, and density seems to follow with comparative slowness. This class has the reputation of giving thin negatives because users are deceived by the rapid appearance of image and take the plate out too soon. In the second class of developers (represented by hydroquinone (quinol), strong pyro, and adurol) the lowest tones or detail appear slowly

and by the time they are out the high lights have attained quite a respectable amount of density, and density is afterwards attained quite rapidly. The usual tendency with these developers (which have low multiplying factors in



FIG. 11c.—Factor 8.

a table I shall give) is to overdevelop and thus get too much contrast.

It really does not matter which developer you use if you take the plate out of it at the right stage of contrast; for all (variations in bromide excepted) give identical negatives if their action

is stopped at the right moment. For general purposes it is more convenient to use a developer which is neither in the first class or the second but intermediate, density following the appearance of the image at a comfortable rate. It is a peculiarity of pyro that it belongs to the first or the second class according to the grains of pyro to the ounce of developer.

#### HOW TO DEVELOP.

1. Select a developer which gives a suitable contrast in a convenient time, and do not depart from it.

2. Stop development at that stage which gives the contrast required.

The problem therefore is resolved into one of

#### WHEN TO STOP DEVELOPMENT.

If a given formula always worked at a given speed, there would be no need of any other plan than that of developing for a fixed time to get a fixed amount of contrast. But unfortunately variations in temperament (and in amount of alkali, etc.) alter the speed of development enormously, and it is im-

possible to work at a uniform temperature.

It is absolutely misleading for writers to glibly advise a temperature of, say, sixty-five degrees, when nothing short of keeping the whole of the darkroom at the desired uniform temperature will secure the result. It is useless to warm or cool the developer alone, for within half a minute after pouring on it strikes an average with the temperature of the room, plate and dish.

In the next chapter I shall describe the simple means I have discovered for timing development.



## CHAPTER IV.

## PREPARATIONS.

I presume that you have provided yourself with a "darkroom." That is a room in which the only source of light is covered up with red, orange or yellow glass or fabric. Also you know that (until it is "fixed ") the plate must not be exposed to any other light besides this. A beginner usually adds greatly to his difficulties by providing a miserably small darkroom lamp or candle, which is little better than darkness. As regards apparatus you will require at least two dishes or trays the size of your plate (select deep ones), one for development and the other for fixing. Also a light tray or cover of a larger size to cover up the developing dish from light.

Make up a "fixing solution" by dissolving 4 ounces of hyposulphite of soda in 20 ounces of warm water. This is called hypo for short. You will also

want at least one graduate, a 4-ounce one is perhaps the most convenient.

#### THE DEVELOPER.

It may seem curious that I am not going to give the formula for some special developer, but knowing, as I do, that there is no particular merit in any one mixture, I advise that you use the formula given by the platemaker, or the one to which you are accustomed. It does not matter much whether you use pyro or one of the newer developers, there is only one developer which it is well to avoid and that is hydroquinone. This is because its factor is so short that it is apt to lead to over contrast. Pyro is more apt to stain the fingers than the others, but it is cheaper, and at least equal in merit.

#### WHEN TO STOP DEVELOPMENT.

About 1893 I found, after many trials to establish the fact, that any change of temperature (within limits) or of amount of alkali, and also strength of developer, with most developers, which lessened or increased the time required for a certain amount of contrast in the

negative, also altered the "time of appearance" in exactly the same ratio.

The "time of appearance" is the time elapsing between pouring on the developer and the first appearance on the plate of any trace of the image.

My plan, therefore, is to develop the plate for a certain multiple of the time of appearance, and a standard amount of contrast will always be secured, even with considerable changes of temperature or alkali. This multiple is called the multiplying factor. With most developers the multiplying factor remains the same for different strengths of developer, but pyro is an important exception to this.

It really amounts to making a test of the activity of the developer and regulating the time of development accordingly.

#### PROCEDURE.

You have decided what developer to use and have it ready mixed (according to instructions given by the plate-maker) in the graduate. Place the plate, face upward, in the dish, take out your watch, and the moment the second hand touches an even minute, pour on

and rock the dish, watch very carefully the creamy surface of the plate and the moment any trace of the image (the high lights come first) begins to appear, note the time. The time elapsing between pouring on and the first appearance is the time of appearance, and this, multiplied by the multiplying factor, gives the total time for development. When you have noted the appearance of the image, cover up the dish from the darkroom light, as it need not be looked at again until the calculated time is up. The dish should be rocked occasionally. It is usually convenient to count seconds when you pour on, a half-second pendulum (as used in my exposure meter) being a convenient timekeeper, as the beats can be counted by touch without looking at it.

When the time has elapsed, pour the developer out of your dish or tray and wash the plate (still in the dish) with water from a tap or jug. There is no need for more than a rapid swirl. Then place in the hypo solution in the dish set apart for that, the plate being still face upward. It must remain in this until all the milky white has disappeared and must be left in about as long again.

The plate must then be placed in running water for at least an hour to wash. It is best to be in an upright position or face downward while washing, but in the latter case the plate must of course not touch the bottom of the washing tank or vessel.

When dry the negative is ready for printing from.

*Example of use of the multiplying factor:*

The Cramer Pyro soda developer of minimum strength (about two grains pyro to ounce) is used and the approximate factor for this is 12. The image appears in 30 seconds and it must therefore be developed for 6 minutes. It must be clearly understood that when I quote a multiplying factor for a particular developer I give it as a guide for the first trial, and it is quite likely that the factor may require to be altered to suit individual needs, but when *once fixed* upon it need not again be altered. If the suggested factor gives too much contrast in the print, use a shorter factor in future; if the print is too flat, use a longer factor next time. In this system the exposure will decide the density of the negative, and the development the

contrast between the tones. Do not attempt to regulate the density of the negative by the development.

## SUGGESTED MULTIPLYING FACTORS.

						Factors.
Pyro soda, 1 grain pyro, no bromide.....						18
" 2 grains " " " .....						12
" 3 " " " " .....						10
" 4 " " " " .....						8
" 5 " " " " .....						6½
	Pyro.		Bromide.			
" 1 grain.....		¼ grain				9
" 2 grains ....		½ "				5
" 3 " ....		¾ "				4½
" 4 " ....		1 "				4
" 8 " ....		2 grains				3¼
Adurol .....						5
Kachin .....						10
Hydroquinone .....						5
Eikonogen .....						9
Metol.....						30
Glycin .....						7
Amidol (2 grains).....						18
Rodinal .....						40
Ortol .....						10
Pyrocatechin .....						10
Imogen sulphite .....						6

In a combination developer the factor is decided by the proportion of its constituents. Thus, if it contains two parts of hydroquinone and one part of metol, three parts in all, you put down

the factor for each of the parts and divide by three, thus:

$$\frac{5 + 5 + 30}{3} = 13\frac{1}{3}.$$

It will be noticed that the factors for pyro vary with the strength in grains to the ounce. Amidol is the only other developer the parts of which vary with the strength. With most developers the factor remains the same with different strengths. With pyro, too, the factor is very different when bromide is used to what it is without bromide.

Do not alter the factors for over or under exposure, and if your negatives are either too dense or too thin (the contrast being about right) remedy the matter next time in the exposure, not in development. Amount of alkali in the developer does not require an alteration of the factor.

As a guide to the factors for different platemakers' pyro developers I give the grains pyro to the ounce for each; the factors can be found in the "no bromide" list: Seed A. B. C., 5; Seed pyro,  $2\frac{1}{2}$ ; Stanley, 3; Cramer, maximum strength 5, minimum strength 2; Hammer,  $2\frac{1}{4}$ ; Eastman, 2; New

American, 3; New York, 2; Wuestner Eagle, 1; Carbutt, maximum strength  $2\frac{1}{2}$ , minimum strength  $1\frac{1}{2}$  (this developer contains bromide).

Pyro ammonia development can not be timed by my method on account of the volatile nature of the alkali.



## CHAPTER V.

## CHOICE OF DEVELOPER.

I have already explained the two classes into which developers may be divided — those in which detail appears quickly and density follows slowly, and those in which detail appears slowly and density follows quickly. It is a favorite error with some writers to state that with developers of the first class (such as metol) the detail and high lights appear all at once. As a matter of fact the different tones of the image appear in exactly the same ratio whatever developer is used, if they are equal as regards bromide. For instance, suppose metol is used, the high lights appearing in ten seconds, the half-tones and shadow detail following in fifteen and twenty seconds. Try the same exposure with, say, hydroquinone, and if the high lights appear in one minute the other tones will follow in one and one-half and two minutes — exactly the same ratio as in the case of metol. Although both classes of developers give

exactly the same result if stopped at the same stage, there is undoubtedly a tendency among those who use the first (quick detail and high factor class) to get soft negatives of little contrast; because development seems a long time reaching the "contrasty" stage. This first class, therefore (which may be defined as a developer whose multiplying factor is 14 or higher), is the most suitable to select for snapshots in sunlight and all subjects which have strong contrasts which must not be exaggerated.

On the other hand, there is a strong tendency among those who use developers of the second class to get their negatives too "contrasty" or tending to "soot and whitewash." So marked is this tendency among beginners using hydroquinone that an editor has told me that in prints sent in for criticism he could pick out, one after the other, all those developed with hydroquinone, and on referring to the notes find his judgment right in three cases out of four. This is because density comes so quickly that it is seldom that an error is made on the side of under-development. This second class, therefore

(which may be defined as a developer whose multiplying factor is 8 or under), is the most suitable for subjects of little contrast, or those which it is desirable to represent with increased contrast. For my own part I prefer to use one standard developer for all classes of subjects, but to select one which is intermediate in character with a multiplying factor not lower than 6 and not higher than 12 or 14. I think it is difficult to imagine a more satisfactory developer than the favorite metol-hydroquinone. The factor is suitable and may be regulated by the proportions of metol and hydroquinone, and it is quite active enough when used with ordinary carbonate of soda (sal soda) without resorting to caustic alkali, as is almost necessary when using hydroquinone by itself. To those who do not object to stained fingers pyro-soda is excellent; its factor alters with dilution and a strength of two grains to the ounce is, on the whole, the most convenient.

#### CONSTITUENTS OF THE DEVELOPER.

The active part of the modern developer is the developing salt. This, as a rule, is a definite chemical sub-

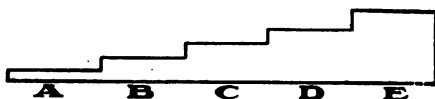
stance, not a mixture of several substances. At one time pyrogallol (usually abbreviated to pyro) was the chief substance so used, and it still remains the favorite. Other developers introduced since are known as quinol (hydroquinone), metol, eikonogen, amidol, glycin, ortol, kachin, etc. All of these are soluble in water, but a simple solution of the developer in water is not efficient, and (except in the case of amidol) the solution must be made strongly alkaline to be an efficient developer. The amount of alkali used influences the speed at which the developer does its work but (within limits) has no other influence. The alkalis generally used are carbonate of soda (otherwise known as sal-soda or washing soda), carbonate of potash, and caustic soda or potash. Liquid ammonia (a solution of the gas ammonia in water) was formerly much used, but its volatile and uncertain character makes it impracticable for exact results. The caustic alkalis are rather objectionable because if too strong they attack the gelatin in the plate. They are found necessary with

a quinol developer, the ordinary carbonates not being vigorous enough with that salt. But in the modern metol-quinol developer the caustic alkali is not necessary, and its use should be abandoned.

It is found by experience that there is no advantage in using very strong developing solutions, and that, on the other hand, very weak solutions take too long to do the work. For instance, with pyro it is known to be useless to have more than eight grains pyro to the ounce of water and four grains is the maximum working amount, while on the other hand one grain to the ounce may be taken as the minimum useful strength. Within these limits the rapidity of development varies with the strength of the developer, the proportion of alkali to the developing salt remaining the same. Similar limits will be found with other developers. In the same way the proportion of alkali to the developing salt lies within narrow limits, being (with carbonate) from six to twelve times the weight of the developing salt. The published formulæ of the handbooks and the platemakers are fairly safe guides in this matter.

## USE OF BROMIDES.

While variations in developer and alkali have little other effect than altering the speed, quantity of bromide has a marked effect. Let us suppose Fig. 12 *a* represents the steps of gradations which

FIG. 12 *a*.

have been produced by development for, say, five minutes without bromide. Fig. 12 *b* will represent the same gradations if developed for the same time with a developer exactly the same except that a little bromide is used. There is the

FIG. 12 *b*.

same steepness of gradation or contrast in both cases, but the bromide has retarded development in all tones and

has prevented the lowest tone A from appearing at all. In fact it has produced exactly the same effect as if a shorter exposure had been given. But the curious point (discovered by Messrs. Hurter and Driffield) is, that with longer development bromide loses its restraining power, and if you want to develop for steep gradations you will gain no control by the use of bromide. There is another point; it is too late to add bromide for overexposure after all the image has appeared. It is now known that the use of bromide makes speed tests unreliable, as you get a different speed reading at one stage of development to what you do at another. As with good modern plates bromide is no longer required to hold back fog, its use is unnecessary for all ordinary work. The restraining power of bromide is best taken advantage of in connection with a low-factor developer, such as quinol. An overexposed negative can be made to appear correctly exposed by such a combination, as the lower tones are held back for sufficient time to get a very useful amount of contrast. With high-factor developers, such as metol, you may try in vain to

influence gradation by the use of bromides.

#### PRESERVATIVES.

I have explained that the developing salt must be used in an alkaline condition to be effective. But if you want to keep the solution in a bottle, it should be in a slightly acid condition. As a rule, therefore, it is convenient to make separate solutions, and not mix until wanted; the developer (slightly acid) being in one bottle and a solution of the alkali in the other. Meta-bisulphite of soda (or potash) is perhaps the most convenient acid preservative. Half the weight of the developing salt is quite sufficient.

#### SULPHITE.

Sulphite of soda in the pyro developer prevents the formation of a yellow pyro stain image, and therefore keeps the negative black. It is not a preservative and (except perhaps for bromide papers) it is not needed for any other developer except pyro, and if you are content with a yellowish image it is not needed for that. When used, it is best dissolved in the solution of the



alkali, and, as Chapman Jones has pointed out, should (to prevent the pyro stain) be in proportion to the bulk of water, not in proportion to the grains of pyro. No less than twenty grains to the ounce of developer should be present. The modern developer usually consists of two solutions, the first containing the developing salt and the acid preservative, and the second the alkali, with the sulphite, when this is used. The two solutions are usually mixed in equal parts.

## CHAPTER VI.

## TREATMENT FOR VARIATIONS IN EXPOSURE.

The old plan of procedure was this: When the negative showed by the rapid way in which the tones followed each other in appearing that it was overexposed, some bromide (usually bromide of potassium) was added to the developer as quickly as possible, or development was completed with a new, strong developer, with an extra amount of bromide. It is now known that this alteration of developer is practically useless *after the tones have once appeared*, as the bromide is unable to exercise its function of holding back the lower tones under these circumstances. It is true that overexposure can be compensated by using (from the commencement) a short-factor developer with plenty of bromide, as with this combination development is completed within the "holding back" stage due to the bromide.

But as overexposure is not usually known before the image is seen, and it is then too late to alter the developer, bromide has in practice very little value as a corrective of overexposure. There is a curious tendency to take overexposed negatives out of the developer earlier than correctly exposed ones, and this leads to the entirely mistaken idea that overexposure leads to thinness. The thinness is the result of underdevelopment. Expose a plate for say four different times (1, 2, 4, 8 seconds) by pushing in the slide between the times, and then develop it. You will be cured once for all of the "thinness" idea, for (within limits) the longer the exposure the greater will be the density of the different exposed portions. You can get almost uniform results from considerably varying exposures if you make up your mind to put up with negatives of varying density.

In Fig. 14a, for instance, the exposure was one second and it was developed with a one grain pyro developer ( $\frac{1}{4}$  grain bromide) for nine times the appearance of the image. In Fig. 14b the exposure with same plate, light and stop was ten seconds, and this was also



FIG. 14a.

developed in the same developer for nine times appearance. The shorter exposure is much the thinner negative of the two and takes a much shorter time to print, but the gradation of the two negatives is practically alike.



FIG. 14b.

With some plates the range of variation of exposure within which practically equal results may be attained in this way is considerably wider than one to ten. It depends upon the quality of the film, but there is always a limit of ex-

posure below which detail is hopelessly underexposed, and another above which the upper tones are made gray and equal by overexposure. The medium between these extremes is correct exposure. Occasionally plates are met with so poor that no variation of exposure is permissible for best results.

#### THE SEXTUPLE METHOD.

I have advocated that the multiplying factor be varied so as to give the right contrast with the developer selected. There is, however, a special advantage in adhering to a factor of 6, because the time of appearance in seconds translates itself into the time of development in minutes without mental effort. For instance, an appearance of 55 seconds requires  $5\frac{1}{2}$  minutes development, 60 seconds 6 minutes, and so on. If this plan be adopted, instead of altering the factor to alter contrast, the density-giving composition of the developer is altered. Pyro is the most convenient for the purpose, as simple dilution makes the required alteration. A pyro soda developer, with two grains pyro and one-half grain bromide, is probably the best standard to make up. It will

give rather too much contrast and will require diluting so as to bring it down to one and one-half or one and three-quarters grains to the ounce. If contrast in the negative is too great dilute the developer; if too little use it more concentrated.

The modern developers can not so easily be adapted to the sextuple method, as dilution does not alter the factor. Hydroquinone could be used with a small proportion of metol added, according to the contrast required, and so could adurol. The proportion of metol required to hydroquinone would be from one-sixteenth to one-eighth.

There is a similar advantage as regards calculation in keeping to a factor of 12, and varying the developer (which might be two grains pyro without bromide, or metol-hydroquinone with a larger proportion of metol) in accordance with the principles just explained.

#### TIMING BY SEPARATE SLIPS.

Although in the methods I have described the plate is exposed to the dark-room light for a minimum amount of time (for it is covered up after the high light has appeared) there are certain

color sensitive plates with which even such exposure to light is objectionable and which should be developed in total darkness; for the light which is regarded as "safe" with them, is too feeble to conveniently observe the appearance of the image. With such plates — now used extensively for three-color work — I have for some years timed development by the appearance of a separate exposed slip of the same brand of plate. It practically amounts to making a preliminary test of the activity of the developer before pouring it on the plate, and does away with all need of "darkroom light," a darkroom with an ordinary light which can be conveniently turned up and down being all that is necessary. The following is the procedure: Mix the developer, turn down the gas, take a trial slip out of its box and, holding it on a cycling trousers clip, dip in the developer, at once commencing to count seconds. You can probably guess how long the image is likely to appear, and a little time before this turn up the gas feebly for an instant, and notice whether the image has appeared on the slip; if not, turn down again, and repeat a few seconds later.



In this way the time of appearance is noted and multiplied by the factor (which is usually about one-third longer than those given in the table) the total time of development is known. The plate is then put in the dish, the developer poured on in total darkness, the dish covered up and left for the calculated time (being rocked once or twice) when the plate is taken out and fixed in darkness. The slips are made by exposing a plate to a standard candle at one meter for four times the inertia of the plate. The plate is exposed in a printing-frame behind a grating made by pasting half-width lantern-slide binding diagonally on a glass plate. The exposed plate is cut into strips about 1 by  $\frac{1}{2}$  inch and stored in a box for future use. If H. & D. speed numbers are marked on the box the number of seconds to expose the trial slips may be ascertained by the following formula:

$$\frac{34 \times 4}{H \& D \text{ number}}$$

This method can be used for any plate besides color sensitive ones, and is theoretically more perfect than the previously described plan of timing by

the appearance of the high light on the plate itself, because it gives the same development to over and under exposure (which is correct) and does away with any variation in the intensity of the high light. The theoretical defects of the previous plan are, however, very slight in practice.

The timing slips are not obtainable commercially at present.

#### QUANTITY OF DEVELOPER.

A grain of developing salt can reduce or develop a certain amount of image, and when it has done this its power is exhausted. Moreover, a certain amount of bromide is set free in development and added to the solution. A developer is therefore in a totally different condition after developing a negative. The time of appearance makes approximate allowance for the altered energy if a developer is used for a second time. But the plan is not one I should advise as a rule. Modern developers may be used a second time if it is done immediately; pyro developers should never be used a second time. It is also bad economy to stint the quantity of a developer for

each plate. There is a tradition in England that one ounce is enough for a  $3\frac{1}{4}$  by  $4\frac{1}{4}$  plate and two ounces for a 5 by 7. I have always found this quantity to be quite insufficient to make certain of the plate being well covered, half as much again being in my experience the minimum safe quantity. Not less than  $2\frac{1}{2}$  ounces of developer should be used for a 4 by 5 plate. It must also be remembered that the principles of development which I have propounded presume that an ample sufficiency of developing salt is present. It is possible to use a developer so weak in the salt that when a feeble stage in contrast is gained there is no developing energy left for more work, and a feeble negative results, however long the plate is left in. With dilute developers the bulk used should be increased proportionately.

## CHAPTER VII.

After the beginners' blunder of underdevelopment, perhaps the mistake which is most often made, and which even experience does not seem to eradicate, is that of forcing on development to bring out detail. There is absolutely no power in this direction. When you have carried development to the stage which gives the right amount of contrast, nothing you can do (or could have done after pouring on the developer) will bring out more detail. Any attempt at forcing development adds far more to the high lights than to the low tones or detail. It is the exposure which decides whether detail in the shadows shall be well rendered, and if you have exposed correctly to bring out such detail, it will (with all ordinary developers) be brought out in development before an amount of contrast sufficient for printing is attained. This even applies to such short-factor developers as hydroquinone and strong pyro, if used without bromide.

Use a developer without bromide, attend to the question of detail when exposing, and to the question of contrast when developing, and you may rest assured that if you do get want of detail in the shadows, nothing you could have done in development would have remedied it. Of course, if you develop too far, the detail in the shadows may appear to be lost because you have to print too deeply to render the high lights properly, and this is the fault that most people fall into when developing snapshots.

Now let us suppose a case where the first of a batch of negatives has been developed, that it is found to be overexposed, and it is desired to remedy the fault in the remainder of the negatives which have probably been overexposed. The remedy is to use bromide in the developer, if you have used none before, or a larger quantity if there was a little in the previous developer. And here the rule that bromide does not alter steepness of gradation (with same time of development) comes in useful. You know from your first plate the time to develop and you have merely to give the same time with the same developer,

plus the additional bromide. The bromide will practically reduce the speed of the plate and will have much more effect in this direction with developers of short factors than with high factor ones. In fact, it is of little use to try the plan with the latter class of developers. It is also useful to remember the same principle when the plan of timing by separate slip is followed, for if you use a developer without bromide and know its factor, and for some special purpose wish to use bromide, proceed as follows: Mix the developer without bromide, test this with the slip and calculate time with the usual factor. Then add the bromide and develop for the calculated time.

#### INTENSIFICATION AND REDUCTION.

Although these processes scarcely come within the scope of my papers, it is well to grasp the part they play in connection with development. Intensification is equal to a continuation of development, and leads to increased contrast without danger of the introduction of fog, if it has not commenced to appear. A thin, rapid plate, which in

itself is not, perhaps, capable of rendering much contrast, will give a much greater contrast if it is intensified after development. The ordinary mercury intensifier is satisfactory, the plate being whitened in a solution of one-quarter ounce bichloride of mercury to twenty ounces of water (it takes a long time to dissolve), thoroughly washed, and after exposing to light blackened with any developer.

Reduction was until quite recently a most unsatisfactory process for negatives, as the reducer attacked the lighter tones and falsified the gradation. But a more satisfactory reducer has been recently discovered in ammonium persulphate. When this is used the action is exactly equal to undoing part of the development, and the result is the same as if development had been stopped at an earlier stage than was actually the case. Reduction with persulphate, therefore, serves to correct mistakes of overdevelopment. It must be used with the utmost watchfulness. Both intensification and reduction should be regarded as exceptional weapons, to be used only when an error has been made in development.

## THE EIKRONOMETER.

Although most people time development with the aid of an ordinary watch, it is by no means a convenient instrument for the special purpose, as the minute divisions are too small and it can not well be started at zero. The eikronometer is a small clock designed for darkroom use. It has a ten-minute dial, with large figures and a calculator for multiplying appearance by the factor. It is started at 0 when developer is poured on. A half-second pendulum will be found a most convenient aid to counting seconds (for time of appearance) in the darkroom. It is easily made by fastening a bullet to a  $9\frac{1}{2}$  or 10 inch chain or string. It can be suspended to the finger or the edge of a shelf. Seconds are counted at one end of its swing.

## SUMMARY.

Keep to one plate.

Keep to one formula of developer — of medium multiplying factor, and without bromide by preference.

When exposing consider only rendering of detail, and leave contrast for development.



When developing consider only contrast, and leave detail to take care of itself.

For the same contrast as appears in the subject keep to a standard multiplying factor.

For more contrast than is in the subject, increase the factor; for less contrast, decrease it.

I am convinced that the worker who follows this method and these principles can secure the utmost control over results that the plate and developer is capable of.

#### CONCLUSION.

It is too much to hope that these chapters leave no word unsaid. I have rather aimed at building up a sound framework than at absolute completeness of detail.

The march of progress in photography tends to greater scientific accuracy in method in place of the old plan of relying upon personal experience only. "Knowledge," says Dr. Hill, in his "Introduction to Science," "is a pile of bricks; science is masonry."

In the kindred subject of exposure, I introduced eleven years ago a plan of

basing the time of exposure on a test by an actinometer of the light actually falling on the subject. Much despised and laughed at in the first place, its value is now generally acknowledged, and thousands on both sides of the Atlantic use my exposure meter. So on this present subject I take as a basis an actual test of the activity of the developer, and in the face of a good deal of derision from photographers of the old school the method has quietly gained a position. It is adopted in a number of beginners' text-books. Teachers in photographic classes find that they no longer need tell their pupils that "nothing but experience" can teach them how to develop, but are able to give definite and exact information.



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# PHOTOGRAPHIC PRINTING PROCESSES.

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## CHAPTER I.

Little or nothing is claimed in the way of originality in the following series of articles. Nothing startling will appear. The aim is to present to the reader in a concise manner the methods employed by practical photographic printers in making prints on the various grades of prepared papers now on the market. No formula for preparing sensitized papers will be given. Good formulæ are the manufacturer's stock in trade and are closely guarded. If one is inclined to experiment in that direction, there are many formulæ published which may be taken as a base. Some are fairly good; many are indifferent and most of them are useless.

It is taken for granted that the worker has had enough experience to



produce a fairly good negative, although it is possible at times to make a very good print from one of inferior quality. Methods for doing so differ with the kind of paper being used and the matter will be discussed while the individual papers are being considered.

There are many things to be considered which apply to the handling of all papers and we will deal with these first.

The first article needed is a printing-frame, and it is important that it should be of the right kind, as it may cause trouble. A first-class frame should be made of hardwood, with the corners dovetailed together. The thin strip of wood on the face, which projects into the opening to hold the negative, should be glued to the frame, or fastened in such a manner that it can not become loosened. Negatives are often broken by this strip becoming separated from the body of the frame. The inner edge of this strip should be beveled outward, so that there will be no corner to throw a shadow on the edge of the negative.

The hinged back should be made with the grain of the wood running both ways, either of two thin pieces

glued together, or of one piece with cleats tongued and grooved across the end of the grain. This is to prevent warping. For small sizes the back, which is hinged about one-third of the distance from one end, is the most convenient. Large frames are more easily handled if hinged in the middle. The back should fit snugly into the frame so that the possibility of its shifting on the negative is lessened. The springs should be pivoted exactly in the center of the piece to which they are attached, so that the pressure is equal over the entire surface. These springs must be strong enough to press the back firmly against the negative and to hold it in position while one side is opened to examine the print. Printing-frames, when not in use, should be kept in a dry place to prevent warping.

Felt pads should be provided for each frame. These pads may also be made of flannel or any soft cloth. If the flannel is thin, several thicknesses must be used. Be sure that these pads are perfectly dry while in use.

Another very important tool for printing is a soft camel's-hair brush, to be used for dusting.

For all processes where a contact print is made on a paper support, the manner of putting the negative and paper into the printing-frame is the same and will be explained under the general heading. Remove the back and grasp the frame in one hand, allowing the fingers to project into and through the opening. Take the negative, holding it by the edges, in the other hand and place one edge in the opposite side of the frame, with the film side up. Lower the other edge until it rests on the fingers of the hand holding the frame. Now grasp the frame with the other hand and by lowering the fingers upon which the negative rests, it is put into place noiselessly and with no danger of breaking. Then lay it on the table.

Take a sheet of paper in one hand, holding it by the edges, and dust the surface carefully, to remove any dust or paper lint. Dust the face of the negative, using the tip of the brush only, to avoid any possibility of scratching. Do not blow on the paper or negative. Small drops of saliva might moisten the film and cause the paper to stick, with

the result of making a defect on the negative which is difficult to remove.

Place the film side of the paper against the film side of the negative and place a pad on top of the paper. Now put the back in place and turn the springs into position, with the ends under the catches. The use of pads insures perfect contact and reduces the chance of breakage should either the frame or negative be warped. Negatives often crack while printing in the hot sun, but I do not know of a single case of such breakage when thick pads were used.

Before setting the frame in the light to print, clean the back or glass side of the negative. It is often necessary to use a damp cloth to remove finger stains or other matter which can not be dusted off.

During the course of printing, especially if it is being done in the open air, see that no dust settles on the negative. If you notice any, brush it away. It might leave partly printed spots on the paper.

Never touch the film side of either negative or paper with the fingers. If the hands are sweaty, no matter how

little, it will invariably show on the finished print. If you are in the habit of being careless in this respect, just stop and think what perspiration is composed of. Aside from water, it consists mainly of oily matter, salt, lime, ammonia and iron, besides a large quantity of carbonic acid gas. It sticks like glue and will tarnish pure gold. Bear this in mind when printing and you will have one less trouble to account for.

To examine the progress of printing, press down on both ends of the spring and turn it so that one section of the back may be opened and the paper turned back for examination. Do not shove one end of spring around and let it fly open with a snap. You would probably move the paper on the negative and might break the plate by so doing.

These suggestions apply to plain printing only. Methods for vignetting, printing cloud effects, borders, panoramic printing, etc., will be given later on.

The kinds of trays to use and how to care for them is a matter to which a great many workers do not pay nearly enough attention. It is of the utmost importance, and the use of trays un-



suited to the purpose, or not kept in proper condition, is the cause of unlimited failures, both by professional and amateur. The proper tray to use is one that is not affected by the chemicals in the various solutions and can be easily cleaned. The material of which it is made must not be porous and it must not have any cracks in which any sediment can lodge.

Glass trays are undoubtedly the best, although glazed crockery or earthenware are equally as good. These are unaffected by chemicals and the surface being perfectly smooth is easily cleaned. Fiber trays answer very well if a separate tray is provided for each bath used. I would not advise the use of so-called hard rubber trays at all. In the first place most of those sold and guaranteed to be of this material are not made of it. They are expensive, easily broken and are apt to be affected by chemicals; especially developing agents. Metal trays will not do, no matter how prepared.

Large trays of any of the materials just mentioned are too expensive and are not easily obtained, so it is generally necessary to provide substitutes. Usually

these are made of wood and either lined or coated with some substance which is chemical proof. All stock dealers sell them, but they are easily made and I will give a few points on their construction which some readers may find of use.

Large trays should be made of as light material as is consistent with sufficient strength. Seven-eighths inch lumber for the sides and one-half inch boards for the bottom is generally used. The sides should not be made flaring. They should stand straight up at right angles with the bottom, so that if the tray is rocked the water or solution will not spill out. Trays should always be at least twice the size of the sheets of paper to be handled, so that two piles of prints can be made. The prints may then be moved from one pile to another without much chance of tearing and can be kept well separated.

A thoroughly practical and cheap tray is made by lining a wooden box with oil-cloth. It makes little difference how the box is constructed. Decide on the size and depth wanted and be careful to make it deep enough to prevent spilling when rocked—say about 3

inches for a tray 16 by 25 inches. Nail the sides to the ends and square the frame. Then nail on the bottom and smooth up the ends of the wood. Line it with common thin oil-cloth, such as is used to cover kitchen tables. The color makes no difference, but if white is used any dirt or sediment is readily detected. Fold the corners in any manner that will not crack the hard surface. Fold the cloth over the top of the sides and tack fast to the outside. A good plan is to spread a little glue in patches over the inside of the bottom before putting the cloth in place, so that the tray may be turned bottom side up to drain, without the lining sagging out. Such a tray is perfectly safe to use and may be easily relined.

Another good plan is to make a wooden box and paint it with asphaltum. This makes it necessary to have the joints of the woodwork as close as possible. Put on several coats of asphaltum, allowing each coat to dry thoroughly before applying another.

Coating trays with melted paraffin is a common practice, but is not good except for trays used for fixing or last washing. If used for first washing or



toning, the print is apt to be rubbed against the paraffin, which will leave a greasy spot that effectually prevents chemical action.

The trouble and slight expense of providing suitable trays (and plenty of them) is so completely overbalanced by the saving in time and paper and quality of work that it should not be considered for a moment.

## CHAPTER II.

## BLUE-PRINTS.

The simplest method of making a print from a negative is undoubtedly that commonly known as the blue-print process. Very artistic effects may be produced, and a few prints on this paper aid materially in making any collection of photographs varied and interesting. The washed-out, faded-looking failures made by some workers who consider the process too simple to study, should not be allowed to influence one to think slightingly of this paper. Give it a fair trial. Study its nature and manipulation intelligently, and the result will be a friendly feeling toward the lowly.

The paper is prepared by coating with a combination of the salts of iron and potassium. When dry, the printing surface is of a lemon yellow color. The salts, if unaffected by light, are very soluble in water. Subjected to the chemical action of light, or when printing, they change their nature, becoming

blue in color and insoluble. It will be readily understood from this that every precaution must be taken to protect the paper from moisture before use. When purchasing it is policy to accept only that which is packed in sealed tin cans, as the paper which is offered in envelopes, especially if it has been in stock any length of time, seldom gives good results. Fresh paper is always the best.

The printing is done with an ordinary printing-frame. Place the yellow side of the paper next to the film side of the negative, and lay the pad on top of the paper. Be sure and dust both the negative and paper and see that the brush and pad are perfectly dry. Print in direct sunlight when possible. Good prints may be made by printing when it is cloudy, or in the shade, but sunlight is better unless the negative is very thin.

Examine the progress of printing occasionally by opening one section of the back and turning the loose end of the paper so that the face may be seen.

The image will appear slowly and will usually be of a grayish blue color. Carry the printing to a point where the shadows will appear of a gray bronze color and the half-tones be fairly out-

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lined. The beginner should make one or two prints, closely observing the color and depth of the image, and wash them immediately in plain water. It will be an easy matter after this little experience to correctly judge the depth of printing. If these test prints are lacking in detail and too light, the rest of the prints must be carried deeper. If they are too dark, do not print so far the next time.

I want to say to the beginner right here, and it applies to all photographic processes, that you must learn to observe and remember what you see. All that a writer can put on paper is merely a starter for you. Suppose you were learning to coast and some one more experienced explained to you that if you want to steer your sled to the right you should dig in your right toe, and if to the left, use the left one. He gives you a good shove and away you go. Half way down the hill you find you are headed too far to the left, and forgetting or ignoring all advice, you put the left toe down; where do you land? In the ditch. You will find some mighty deep ditches along this photographic hill, and you want to keep your eye

open and your wits about you, or you will get many a spill, and in company with a certain congressman, there will be times when you do not know just where you "are at." If your memory is poor, get yourself a notebook and make a memorandum of everything. If it is your intention to press the button and depend on others for the rest, you are going to make a failure of it.

It is better to print too dark rather than too light, as a dark print, if not excessively overexposed, can be reduced, while the light prints are difficult to improve.

After the printing is done, the prints are washed in plain water, in order to dissolve and wash away the salts which have not been affected by light.

It is advisable not to have the water too cold. Use it warm enough so that the fingers will not become chilled. Do not touch the back of the print with damp fingers, or the moisture may penetrate through to the sensitive surface and cause dark spots. Dry the fingers when taking hold of a fresh print and plunge it into the water quickly, taking care that it is wholly and evenly covered and that there are no air bubbles on the

surface. Be generous with the quantity of water used.

Immediately after placing the print in the water an amber-colored liquid will appear to rise from it. This is the unaltered salts dissolving and washing away. Allow the prints to remain in this bath for about a minute and then transfer to a second tray of water for several minutes. Then place in a third tray or dish, preferably with running water, and wash for fifteen minutes. This completes the ordinary method of finishing the prints and they are then ready for mounting or drying.

A very deep rich blue may be obtained by printing rather deep and adding about ten drops of strong ammonia to each two quarts of the first wash water. Use great care not to have the ammonia water too strong, or the prints will either bleach or turn to a gray color before they can be removed. Ordinary household ammonia will answer, but more must be used, as it is generally very weak. Experiment a trifle and you will get it. Use enough ammonia to give the deep blue, without bleaching.

When the color wanted is obtained, which should be in about a minute, place

the print in a solution of one-half ounce of alum to the quart of water, and allow to remain for four or five minutes, or until thoroughly cleared, and then wash for fifteen minutes in clear water.

Give the prints in all cases the full twenty minutes washing. If they wash out too light, throw them away. They are underprinted and new ones should be made. It is possible to strengthen a weak print, but the necessary chemicals are seldom at hand and the process is uncertain.

Prints which are too dark may be reduced, if not too badly overexposed, by using ammonia in the first wash water, as given above, only a trifle stronger, followed by the alum bath and washing. There are other methods of reducing dark prints, but if they are so overprinted that they require heroic treatment, it is better to throw them away, as they will undoubtedly prove unsatisfactory after being doctored.

Probably the greatest cause of failure to make good prints on this paper (especially by the beginner in photography) is using a negative which is too thin or lacking in contrast. Flat overexposed negatives, or those which are thin

and weak, either from undertime or insufficient development, will not give good prints. The negative should be fairly strong and contrasting, with enough detail in the shadows to prevent the paper printing blocky in these places.

The intention is not to give any information of points in this article but what are thoroughly practical. There is, however, a little matter concerning blue-print paper which can be touched upon that, though rather uncertain, is very interesting. By toning the print after it is finished in the usual manner, you can produce some very fine results, and often puzzle your photographic friends as to just what kind of prints they are. It may also puzzle you to produce exactly the same result again, but the work is interesting and should be experimented with.

One authority (?) states that by washing the print in a ten per cent solution of ammonia and water until the image is nearly or quite bleached out, and then placing it in a saturated solution of tannic or gallic acid until toned to color wanted, followed by thorough washing, it will be toned black. Another



authority gives the same formula and treatment to produce brown tones. I have succeeded in getting both, together with several others.

If you wish to get a green tone, make a saturated solution of proto-sulphate of iron (any tintype man has it), with enough sulphuric acid added to turn blue litmus paper red. For use add an equal quantity of water and allow the print to tone to the color wanted, after which it must be washed thoroughly.

The prints may be dried perfectly flat between blotters. It is generally necessary to change them to dry ones until all the moisture is absorbed. To mount on cards, take the prints from the last wash water and lay them face down (one on top of the other, irregularly) on a piece of glass and squeeze out all the surplus water with the rubber roller. Apply the paste to the back of the top print and lift it with a hatpin or any pointed article and place it in position on the mount. Place a piece of blotting paper on the face of it and roll into contact with the mount with the roller. Sponge away any excess of paste which might be pressed out around the edges. A formula for making a paste that will

keep in condition and also stick will be found on page 51.

Blue-prints may be spotted with water-colors or paints, or by scraping a little dust from the lead of a blue pencil and mixing it with a drop of gum and applying with a pen or brush.

Use judgment in mounting these prints. A large enough card to allow for generous margins gives the best appearance. Plain gray cards with no gloss look well. The ordinary cheap mount with embossed borders never produces a good effect.

## CHAPTER III.

CHLORIDE OF SILVER PAPER — GELATIN  
AND COLLODION.

For years the most popular paper has been chloride of silver — printing-out, as it is called, on account of the image being visible even to the finest detail during the progress of printing. The paper is prepared by coating with an emulsion of either gelatin or collodion in which the silver salts and preserving chemicals are incorporated. That prepared with gelatin is probably in greater demand when a glossy surface is desired for the finished print. For a matt finish (that is, one without gloss), the collodion is generally selected. We will consider the glossy papers in this article.

If rightly stored, these papers keep in good condition for a considerable length of time. The most trouble with spoilt paper is experienced during the summer season, but the liability of its spoiling can be greatly lessened by keeping it in a dry, cool place. Comparatively

fresh paper gives the best results, but old paper, even though it has colored considerably, can be used and good results obtained. Old paper must be more thoroughly washed, and salt added to the water, if the surface is tinted.

Trays suitable for handling this paper have been described in a previous article. It is absolutely necessary that the trays used be perfectly clean and a separate tray used for each bath and for that particular bath only. Five trays are required — one for the first washings, one for toning, another to hold prints after toning, a fourth for the hypo bath, and lastly one for the final washing. Don't attempt to use the same tray for the first and last washings. It will work all right the first time the trays are used, but with your second batch of prints there will almost certainly be troubles. Many amateurs, especially beginners, fail to provide the necessary trays, depending on dishes from the kitchen, wash bowls, etc. These workers are constantly in trouble. If rigid economy is necessary and such dishes must be used, scald them thoroughly with the hottest water you can get and be absolutely certain that not a

fraction of a grain of soap or grease remains in or upon them. Always mark the trays so that they can not become mixed when wanted again.

The water, especially for the gold bath, must be pure. Distilled water is best, but is not generally at hand. Rain water is generally good. Melted ice is often recommended, but it is a question whether freezing purifies the water. In the larger towns and cities where there are waterworks, the city water, as it is usually called, is plenty good enough, unless it is drawn from artesian wells, and then it is very apt to be unsuitable. Water for the gold bath should be filtered before the chemicals are added.

Very elaborate plans and specifications are published from time to time describing various means of purifying water. Theoretically some of the processes are good. I never had occasion to test them and do not remember of ever having seen any of the methods described put into use by any one but the inventor. Not one photographer in thousands, either amateur or professional, will make any effort to purify water chemically, and I think they are just as well off. If water is so bad that

it must be treated chemically, the average photographer will figuratively jump from the pan into the fire in attempting to doctor it. Use the water at hand for washing and fixing, unless it is known to be unfit. The water for the gold bath must be pure.

The different washes and baths should be kept at as near the same temperature as possible, and for comfort, if for no other reason, should not be too cold.

The printing is done either in direct sunlight or in the shade. Good printers print under ground glass, or cover the frame with tissue paper. This is especially necessary with thin negatives. Use care that the paper is of a fine texture and not placed too near to the negative or the print will be mottled. It may be necessary to tack a thin strip of wood around the face of the frame and tack or paste the tissue paper to this, in order to prevent the grain of the paper showing. I remember one instance of a print which was offered for inspection which showed large mottled spots over the entire surface, and I was assured that the paper was defective. Upon tracing the matter it was found that

printing had been done in front of a window that was covered with frost. The rest of the paper in that box made good prints. Setting the frame close to a wire fly screen when printing, with the result of leaving the print covered with fine white lines, was another cause of complaint which an inexperienced amateur hastened to make.

Experience must be the teacher as to how far the printing must be carried. As a general rule, for single gold toning the print must be considerably darker than the finished print is desired. With an average negative, carry the printing to a point where the whites will be slightly tinted over; the shadows will be quite dark and the general sharpness and clearness be so darkened that the print will appear rather indistinct. Little can be judged from the color of the print. Paper in good condition, printed from a bright, crisp negative, should be of a rich, warm, cherry color. If a negative is thin and lacking in contrast, either from underdevelopment or over-time, or is foggy and gray, the print will probably be of a bluish tint, or a dirty red color, even though the paper be in perfect condition. Prints from such

negatives are difficult to tone. The negatives should be strengthened.

While it is possible to keep the prints for some time after printing, before toning, it is advisable to finish them as soon as possible.

The first operation of the toning process is the washing, and the greatest care must be taken that this is thorough, for all the soluble chemicals must be washed away. Running water should not be used. It is far better to use several changes of still water.

The manner of washing gelatin and collodion papers differs slightly in that the collodion paper must be flattened to prevent curling, while with gelatin this is unnecessary. When a collodion paper is put into the water, the paper swells across the grain, and one side being held by the film while the other expands, the print first bends and then curls up, sometimes very tightly. This is easily prevented. Place the collodion print in the water and wet it thoroughly. Just as soon as it shows a tendency to curl press it face down on the bottom of the tray. Put in the rest of the prints, one at a time, laying them one on the other in an irregular pile.



After all are in, press them down firmly and pour off the water. Set the tray on edge and allow to drain, pressing out the surplus water with the palm of the hand. Now refill the tray with water and make a new pile of the prints at the other end of the tray, handling them one at a time. Continue stacking them in this manner until they lose the tendency to curl, after which they may be washed without stacking. Stacking in this manner is for the purpose of holding the prints flat until the paper has swelled in thickness instead of across the grain.

Gelatin papers, if very old, sometimes curl a trifle, but it is not necessary to stack them, as they will straighten out after a short washing.

Before handling the prints in the wash water the hands must be cleaned thoroughly. Just rinsing them off will not do. Use good warm water and soap and then plenty of clear water. If you make up your hypo bath just before toning, keep your hands out of it.

The washing must be done in a weak, subdued light. If the light is too strong the whites will discolor and the prints lose their clearness. Keep the prints

well separated and continue the washing for a full half-hour for a small batch and longer for a larger one. You can make it a rule to wash prints for an hour and results will prove that you are making no mistake by so doing.

The last three changes should not show a trace of the milky appearance which the first few washes will, and the prints should be of an even brick-red color. Many printers add an ounce or two of a saturated solution of common salt to each gallon of the second or third wash water to color and clear the prints. It is not necessary, but if you never tried it I would advise you to do so.

Some manufacturers of gelatin paper harden the film considerably and others very little. Either paper gives good results, but, in my opinion, the paper with the smallest amount of hardener in the film is the better. Should it become too soft to handle safely during the warm weather, it is easily hardened. During the preliminary washing, if it is noticed that the film is becoming very soft, or is inclined to blister, add an ounce or so of hardener to the water. Put in a little at a time, so that no more is used than will harden the film sufficiently to stand th

handling. A good hardener formula will be given with the fixing bath. In an emergency a solution of one ounce of alum and a few pinches of salt in say twelve ounces of water, may be used as a hardener, or even plain alum. Use just a little at a time.

Too much attention can not be paid to the proper and sufficient washing of the prints before toning. It is very generally slighted, and those who slight it most to save time are the very ones who will waste an hour writing a four-page kicking letter to the manufacturer when the troubles are of their own making.

Before closing this chapter I want to give a word of advice to those who hasten to send in a complaint every time they spoil a print. If you have reason to suppose that your paper is defective and should be replaced, send a few of the prints showing the nature of the defect and also a few sheets of unused paper for the manufacturer to use in tracing the trouble. Just wrapping the paper in your letter will not do, as it always gets discolored before reaching the factory. Wrap it in black, red or yellow paper. Do not write a long let-

ter stating the name of your camera, its price and date of purchase. That has nothing to do with the matter in hand. Talk to the point. In this way your communication will receive prompt attention and your claims, if valid, will be just as promptly adjusted.

## CHAPTER IV.

## TONING.

The toning bath and manner of using it is practically the same for all makes of paper. Slight variations in the amount of gold and alkali used will often be necessary, but the general principle of the process is the same. Each manufacturer gives a printed sheet of directions with every package of paper and these directions should be studied by the printer, unless he be far enough advanced to regulate the baths to produce the best results. It is not a good practice, especially for the beginner, to change from one brand of paper to another for every batch of prints. The practice is very common. I received a letter from a young gentleman in which he stated that he had owned a camera for something over three months and in that time had experimented (?) with all the different makes of paper in the market, with uniformly poor results. His toning bath he purchased ready prepared from a dealer in supplies (their own

make) and yet he claimed that he followed closely the directions that came with the paper.

It is quite impossible to give the exact proportions of the chemicals needed in the toning bath. The varying qualities of the chemicals and water, as well as the difference in paper and prints, make it necessary for the printer to learn to judge from results how to prepare the baths and keep them in good working condition.

For convenience the materials used should be at hand in the form of stock solution and should not be too strong. Probably the most convenient method of making the gold solution is to dissolve say fifteen grains of chloride of gold in fifteen ounces of water. Each ounce of the solution will then contain one grain of gold, so that in measuring, if one grain of gold is required, one ounce of the solution will contain it. One-half ounce will contain one-half grain, etc.

The alkali should be made in a rather weak solution. Strong alkalis, such as carbonate of soda, are apt to cause trouble unless handled in very weak solutions and very carefully. The milder

alkalis, such as borax or bicarbonate of soda, are the easiest handled and, if used intelligently, give as good results as can be obtained. With either of these two, prepare the solution by placing a handful in a bottle and add three or four ounces of hot water. Shake it well and allow to settle. When clear, pour off the liquid and filter into a bottle, and to each ounce add another ounce of water. This makes a solution strong enough for all practical purposes and yet mild enough so that the danger of adding too much to the bath is lessened. That different alkalis influence the color of the tone is undoubtedly true, but the difference is so slight that I think I am safe in saying that it takes an expert to detect it.

Prepare the gold bath at least several hours before needed, so that it may ripen thoroughly. It is possible to make up the bath immediately before use, but the results are not so certain. For an ordinary bath, pour about thirty-two ounces of absolutely pure water into a bottle and add an ounce of the gold solution, or one grain of gold. Double this amount of gold and sodium will be necessary. To this add say one-half ounce

of the alkaline solution and shake it well. Now drop in a piece of red litmus paper and note results carefully. If the bath contains enough alkali the paper should turn blue in not less than three, nor more than five minutes. If it does not turn color in this length of time add a trifle more alkali and test again. Be very careful in adding the alkali so that too much is not put in, as it is much less trouble to do it slowly than to have to weaken the bath or neutralize it again with acids. The litmus paper used should be of soft paper and of good color. Use only that sold in tubes and bearing the label of a reliable manufacturer, not of a dealer.

The bath should then be set aside to ripen, for several hours. When the bath is ready and the print well washed, test the toning bath with one or two prints before placing too many in it. On an average prints should tone in about ten minutes. Some printers tone a trifle faster and some more slowly. Should the bath tone too rapidly add more water to weaken it. If too slowly add a little gold, a few drops at a time, until the right speed is obtained.

Toning can not be hurried. If you



expect to wash, tone and finish a batch of prints in twenty minutes or half an hour, don't say a word about the results. Grin and bear it and the next time you tone go about it leisurely.

If the bath is in good condition and working at the right speed, the first results noticed will be the clearing of the whites. This change should not commence to show until the print has been in the bath at least thirty seconds. In a bath that is evenly balanced the whites clear slowly and the whole print takes a gradually deepening and darker tone, with the finer details becoming more clear and distinct.

Should the bath clear the whites too rapidly it is either too strong in gold or too alkaline. If too strong in gold the effect will be principally on the whites and half-tones, clearing them quickly with no immediate effect on the shadows. If too alkaline the whites clear quickly, possibly taking an old-gold, yellowish tint, and the half-tones assume a bluish color. A bath which is too strong in both gold and alkali will tone too rapidly; the whites will bleach and the half-tones take on a faded, over-toned appearance, while the shadows

will probably be mottled and granular. This will especially be true if the bath be not sufficiently ripened.

For sepia tones the printing should not be very deep, only a shade or two darker than wanted when finished. Tone in a bath weak in gold, and carry the toning only a trifle further than is enough to change the bricky red color of the print. For the warmer or cherry tones, use the regular bath and carry the toning well along until the red or yellow can not be detected in the shadows when the print is viewed by transmitted light. Experience, gained from observation, must be the teacher, as to how far the toning must be carried. Some brands of paper change very little during fixing, while others do not fix out at all as they appear when coming from the gold. The nature of the paper in this respect can only be learned by repeated use and this fact more than almost any other should be the reason for not changing from one to another make too often.

There are many printers who seem to think that the more different chemicals they can get into a bath the better it is. Fortunately they are comparatively few

in number. Common table salt is recommended and the printer should experiment with it, commencing by using only a few grains. Much is claimed for acetate of soda. It should be made into a solution and used very sparingly. Sulphite of soda has also been mentioned, but the only possible action I can notice is that it makes the bath work slowly if used in very small quantities and if in large amounts it stops toning entirely.

The best practical printers use water, gold and alkali. If there was any virtue in using other salts, it seems to me that the men who handle the big batches would have discovered it and made use of them, but I positively do not know of a single one who does so.

As to whether it is better to use a bath that is entirely new or to save and use a part of an old one is a question. Personally I prefer a new one if it is thoroughly ripened, but most printers use part old and part new, on an average, I should say, of about half of each. Certainly the results are good.

Toning should be done in a weak light. The prints should be kept well separated and be moved about occasionally. As each print attracts and retains

a part of the gold in the bath it is constantly weakening and more gold must be added from time to time. It is better to add a few drops at a time, occasionally, than to wait until the bath has weakened considerably and then add in quantity, as by so doing the bath is kept more uniform and works more evenly.


## CHAPTER V.

## FIXING.

As soon as each print is toned it is placed in clear water until all are done and then the batch should be put through one or two changes before being placed in the hypo bath. It used to be considered necessary to have a little salt or a few drops of acetic or other mild acid in these wash waters to act as a short-stop, or in other words, to stop the toning. It can do no harm to use either in very small amounts, although I can not say that I believe it does any good. I have toned batches of prints numbering hundreds and even into the thousands and not used anything but plain water. The fewer chemicals used the better.

Care must be exercised in preparing the hypo-bath. A handful of hypo dissolved in an unknown quantity of water may give good results once in a while, but when it is possible to work with certainty, guessing is poor policy. I got an idea that I could make a fixing bath

of the right strength by tasting it. I practically lost a good many batches, before experience taught me that I was traveling the wrong road. Perhaps my tasting apparatus was out of working order. I know of a number of printers who are making the same mistake every day and from the appearance of their work I think one of their senses is defective also. The hypo sold by regular dealers now-a-days is of a very even grade, so far as quality is concerned, but is sold in such vastly different forms that it can not be accurately measured by weight. It will be found in large lumps and small crystals, and also ground and dried. Some forms will be of twice the strength of another, weight for weight, when dissolved. The bath should be tested for strength with a hydrometer. These little instruments are inexpensive and there is no excuse for not having one. Occasionally we meet a camera-owner who offers as an excuse for not having these little necessities that he only makes a picture (?) once in a while and thinks it not worth while to be properly equipped. It is of no use writing to benefit one who has such an opinion of the work. He never



got a presentable negative or print unless by accident, and never will.

Ordinarily a good strength for the fixing bath for printing-out paper is between 15 and 18 hydrometer test. The makers of the paper give the result of experimenting for the best results in the directions which they give with the package. A slight variation from their figures will make no difference, but it is good policy to follow the directions and be accurate.

When the prints are placed in the fixing-bath they should be put in separately, and while fixing they should be kept apart and in motion. Some makes of paper bleach much easier in the hypo than others, and it is necessary to watch for indications of their doing so. It is usually considered proper for prints to fix for about fifteen minutes. I would not advise anyone to keep prints in the hypo for a longer time, as it will do no good and might do harm. My opinion is that ten minutes fixing in a bath testing between 15 and 18 is right. A course of practical experiments which were made in one of the largest print-rooms in the country showed that this was amply sufficient.

Prints when first placed in the hypo bath will usually change in color somewhat; generally back to a more orange tint and then gradually darken until all unevenness of tone disappears and the whites clear. After the print assumes the even tone and the orange tint disappears the fixing is practically complete, but it should be allowed to remain in the hypo for some time longer to insure thorough clearing.

Gelatin prints are very apt to become soft, especially in hot weather, or if the baths or waters become warm enough to act on the gelatin film.

This is not a defect in the paper. Some brands are made this way purposely. Experienced workers that desire the best results will select a soft paper every time, claiming that should the occasion require it, they can do the hardening themselves.

Very little hardener should be used in the first wash water; just barely enough to toughen the film so that it can be safely handled during the toning. Hardening paper should be done in the fixing bath because it is the most practical. Theoretically, it is advisable that the print should be fixed first and then



hardened, and I have often heard this advocated by amateurs. Theory is well in its way, but life is short.

A solution of alum, added a little at a time, using just enough (and mind you this is a very small amount) to make the surface feel firm to the touch answers very well. Alum is perfectly safe to use, in small quantities.

The following hardener is one that I have used for a long time and it has never failed to give good results. It can be made up in large quantities and kept in stock form, using enough when necessary to produce the results wanted.

Water .....	32 ounces
Borax (powd.).....	3 ounces
Sulphite soda.....	4 ounces
Alum (powd.).....	8 ounces

For first wash use about one ounce of hardener to each quart of water. In the fixing bath use about one ounce to from sixteen to twenty ounces of solution. Prints may be hardened too much. In such an event the film will probably crack if the prints are dried before mounting, and will also do the same while being burnished. Too much is probably worse than none at all.

Don't save a hypo bath for future

use, as it will almost invariably produce yellow whites, after being used a few times. Hypo is so cheap that it hardly seems possible that anyone, for the sake of economy, would want to keep and use it repeatedly; yet we receive dozens of letters asking if it would not be possible to use it over and over, for this reason.

The final washing after fixing must be very thorough. Handling the prints by hand, keeping them well separated and in motion is the best way. If still water is used it should be changed often. Washing by hand for half an hour in ten or twelve changes of water, will be quite sufficient if the work is done thoroughly. Washing for the same length of time in running water, is sufficient, but care must be taken to keep the prints separated and not allow them to come together in a bunch when the tray or dish overflows. Longer washing will do no harm and is generally advisable. The use of so-called hypo-eliminators is all foolishness. You don't know what you are using and it isn't practical anyhow. The probabilities are that you might need an eliminator for the eliminator and so on.

Concerning combined toning and fixing baths I have very little to say. My experience with them has been rather unsatisfactory. There are any number of formulæ published and all seem to work about as poorly as the others, so that if it is desirable to use one, the printer can select almost any of them at random and learn the rest for himself. Many advise their use as time-savers, but I plead not guilty.

To mount a print in a neat manner seems to bother most amateurs. Even though the print be a good one from an A1 negative, the effect is spoiled if it be trimmed with ragged, crooked edges, or has light or dark uneven margins from not being trimmed small enough. If a print is to be mounted directly from the last wash water, the paper should be trimmed before printing. For prints from a 4 by 5 negative the paper should be trimmed to about  $3\frac{1}{2}$  by  $4\frac{1}{2}$ . This will allow for a quarter of an inch all round, which is generally enough to prevent the ragged border of the negative from printing and showing on the finished work. If the print is made without trimming the paper, it should be dried after toning and wash-

ing and then trimmed. Prints may be dried by simply laying them out on paper or cloth that will not stain them, or preferably between clean white blotters.

Trimming prints with a pair of shears is not practical. It takes too much time and the edges are seldom straight. A better way is to make a glass form about one-half inch shorter and narrower than your negatives. You can clean an old negative by soaking in hot water and then cut off a half inch from one side and one end. Lay a piece of fine sandpaper on a flat surface and smooth up the edges of the glass by grinding on this paper, so that you may not cut your fingers.

Now lay your print on a larger piece of glass, face up, with the glass form on top. The form being transparent, you can see just what part of the print is within bounds. Press firmly down on the form and trim the print by drawing a penknife along the edges. Your print will then be square and have straight edges, with no bad margins, and even though it isn't the full 4 by 5 inches, it will be much more presentable in appearance.

Mount prints wet. If they have been dried, soak them for a few minutes in water and stack them irregularly, face down, on a mounting glass and press out all the water you can. Apply the paste to the top print, brushing it well into the fiber of the paper, especially about the edges. Pick it up with a hat-pin or point of knife-blade and lay it on the mount in position. Lay a piece of blotter or damp cloth on top and roll into contact with the roller. Then paste the next one and so on until all are done and lay away to dry. When dry, spot out the light defects with spotting colors or india-ink applied with the point of a fine spotting brush.

Burnish with hot burnisher after lubricating print by rubbing the face with a cloth which has been rubbed against a piece of hard soap, Castile preferred.

## CHAPTER VI.

## SQUEEGEEING PRINTS.

The process of finishing a print by the method known as squeegeeing seems to cause many persons a great amount of trouble, judging from the inquiries we receive as to our way of doing it. As with all photographic processes, some preparation is necessary in order that it be easily done and the result be certain. The ferrotype plates must have a perfectly smooth surface and before use must be washed perfectly clean with hot water, using a cloth or sponge that contains no grit. After the plates have drained, rub them with a piece of soft cloth which has been saturated with a solution of paraffin and benzine or gasoline. This solution should not contain too much paraffin, as when polishing, it may be difficult to remove it. A piece of the wax as large as a navy bean will be

enough in an ounce of gasoline. Rub this on the plate and when the oil has evaporated, polish with a soft cloth, rubbing very lightly so that the paraffin is not removed entirely. Prepared in this manner there is little danger of a print sticking, but when using gelatin paper I would advise placing the print for a few minutes in a weak solution of chrome alum and water to toughen the film thoroughly. Common alum will do as well if the chrome is not at hand. After hardening, the print should be rinsed in clear water. Place the wet print face down on the plate and roll into perfect contact. Prints should be dried slowly, preferably in a draught. Dried by heat the edges break from the plate first and usually curl up, leaving the print covered with circular cracks. A very good way to finish an unmounted print is to back it with cloth or paper. Squeegee the print in the usual manner. Wet the paper or cloth to be used for backing and lay it on glass the same as you would prints when mounting. Paste the top piece and lay it on the wet squeegeed print and roll down. They will dry together.

## PASTE.

Another constant demand is for a good paste which will keep. Dissolve one-half pound of lump starch in twenty-five ounces of cold water. Dissolve one ounce of gelatin or white glue in eight ounces of boiling water. Pour the gelatin solution into the starch. Add one ounce glycerin; one ounce of acetic acid (No. 8) and ten or twelve drops of oil of cinnamon. Boil until the mixture thickens, then strain. This paste keeps indefinitely, if covered when not in use, and never lets go.

## COLLODION MATT.

The collodion matt papers which are generally used by the portrait photographer seem to be especially difficult for the amateur to handle, but it should not be so. The double toning process is very simple, but absolute cleanliness and close observation are essential to success.

Before printing, the negative should be well rubbed with a tuft of cotton to remove any foreign substance from the surface. The negative should have a coat of hard varnish and care should be



taken not to touch either the face of the negative or paper with the fingers. A little oily matter from the fingers, on the face of the negative, will be transferred to the paper when put in contact in the frame. Finger marks will invariably cause red spots. The back of the paper being printed should not be touched with fingers that are sweaty, as it will show on the face every time. Many printers have never noticed this, but it is the cause of many blotches which they can not account for. There is nothing in the film of a good paper that will spot, and when spots do appear you can lay the blame to improper manipulation.

For simple gold tones the paper should be printed just the same as the ordinary glossy paper. Print to the same depth, and tone and fix in the same manner. For black or dark tones, with double toning, the printing must be carried very deep. The quality of negative and nature of the subject has much to do with the depth of printing. As a general rule, printing must be carried deep enough, so that the high lights or whites are tinted over. The detail in the shadows will be nearly, and in some

cases entirely, lost. Prints from contrasty negatives generally bronze more or less in the deeper shadow, but correct toning removes it entirely.

The preliminary washing of this paper must be very thorough. The washing should be done by handling the prints, one at a time, in a tray of still water. Running water will not answer. It is possible to get along without doing so, but as a general rule the prints should be flattened in the first wash water. It requires no more effort to press the prints against the bottom of the tray and hold them for a moment until perfectly flat, than it does to throw them in and stir them about. To flatten prints with the least possible danger of damaging the surface, it is a very good plan to lay a large sheet of glass in the bottom of the tray, and as each print is put in the water it is wetted until it shows the tendency to curl and is then pressed against the glass. When all are in, the glass may be removed and set on edge for the prints to drain. Draining prints in this manner is about the quickest and most thorough method of eliminating the surplus chemicals that one can employ

One or two ounces of a saturated solution of carbonate of soda added to each gallon of the first wash water is very effective in removing foreign matter from the face of the print and is a partial preventive of red spots. While the use of soda is not absolutely necessary, I would advise its use at all times. It should always be used in the first wash water.

From six to ten changes of water are necessary to put the print in the best condition for the toning bath. After the first wash it is unnecessary to pack them; they should be continually handled over. After commencing the washing do not touch a wet print with fingers that are dry; wet them first, or a spot is almost certain to appear.

A little common table salt added to about the fourth wash water will give the print a very good color for toning and clear it nicely. As with soda its use is not necessary, but many good printers use it with the very best of results. The last two changes, at least, should be just plain water.

Washing the prints thoroughly does take time and labor. If you slight it, giving want of sufficient time as an

excuse, you have only yourself to blame. If you can not afford the time to do it right, my advice is not to commence at all. You will make a failure of it.

It is astonishing how very differently printers handle the gold and platinum baths and obtain the same results. One will tone with a bath weak in gold, while the next man will be using one twice as strong. Here we meet a printer who says he gets the best results with a bath very slightly alkaline, and there the next uses a bath that actually feels as though it contained soap, it is so strongly charged with soda. The water being used is not the cause of this either, because in any city, where all are using the same, these varying conditions of the gold bath obtain.

In my opinion a medium strong bath, say about one grain of gold to forty or fifty ounces of water and containing enough alkali to turn litmus in about two or three minutes, is the best. I like to have a print tone far enough in the gold in about eight minutes, yet I know printers who do splendid work, who put them through the gold in about one-third of that time.

Borax is pretty generally accepted as

being the most practical alkali for this purpose, and is certainly good. I am acquainted with one demonstrator who uses chloride of lime and his work is certainly as good as can be produced, but this lime must be handled very cautiously. He prepares his alkali by shaking up a handful of lime in a half pint of water, and after allowing to settle, adds three parts of water to one of the lime water. He then uses enough (and it is very little) to turn red litmus blue.

Considerable has been said of late concerning the use of common salt in the gold bath. It is claimed that the prints tone much clearer. I have tried it in all quantities, with all makes of paper, and positively can not see that it improves matters any. I have talked the matter over with many printers and find that they are of the same opinion.

The same rules hold with these papers as with the glossy, concerning too much or too little alkali. In a previous article this matter was explained and the reader can refer to it for details.

The color of the tone as the print comes from the gold has all to do with the tone which will be obtained in the

platinum. Carried in the gold to a point where the whites have cleared and the shadows have changed only slightly darker, the print after the platinum toning will be of a brownish-black color.

If the gold toning is carried far enough to give the shadows a warm seal brown, with the half-tones rather on the purple order, the platinum will so change it that it will be practically black. Over-toning in the gold so that the image is quite blue, seldom gives pleasing results, as the print generally has a rather washed-out appearance.

Averaging up the work of the general run of printers, the best results seem to be obtained by toning in the gold until the whites clear and the shadows have toned far enough so that the yellow appearance can not be detected in the shadows when viewed by transmitted light. This gives a dark tone, slightly on the brownish-black order. It is very bright and pleasing.

Absolutely black tones are difficult to obtain. Printing from some negatives, it comes easily, while with others it seems to be impossible.

It is advisable to run one or two prints through the gold and then the

platinum, and the result will show how far to carry the rest of the batch in the final toning.

I find it a very difficult matter to describe the toning process very accurately, but I don't remember ever seeing an article on the subject by anyone else that really made the subject perfectly plain. Experience has got to do it. I would not advise anyone to handle the double toning until thoroughly familiar with the glossy papers and plain gold toning. Gold toning learned, the rest is easy.

## CHAPTER VII.

## PLATINUM TONING.

As soon as each print has toned far enough in the gold, it is placed in a tray of clear water and allowed to remain until the entire batch is toned. When all are finished they should be washed well in two or three additional changes of water. This is quite necessary. The gold bath is decidedly alkaline, while the platinum bath is strongly acid. If the alkali is not entirely removed before placing in the acid bath, the neutralizing of the alkali by the acid will usually cause trouble.

The platinum bath should be prepared several hours before use, and should not be used too cold. Potassio-chlorio-platinite is the name under which the salt is generally sold. It should be in clear, brilliant needles and dissolve almost as readily as gold, in pure water. I have tried to tone with certain brands of this salt which are on the market, and could get no results whatever.



About as convenient a way as any for making up the stock solution of platinum, is to dissolve the contents of a fifteen-grain bottle in five ounces of water and then add two and one-half drams of fifty per cent phosphoric acid.

The toning bath is made by using about one dram of the stock solution in eighteen or twenty ounces of water.

Another method is to dissolve the platinum in just plain water for the stock solution. Make the toning bath by adding a dram or two of this stock, to say thirty ounces of water and then put in enough phosphoric acid to give the bath an acid reaction. Saturated solutions of tartaric or citric acid may be used in place of the phosphoric acid in either manner of preparing. I prefer phosphoric, though I know many good printers who use the others and produce the very best results.

It is policy at all times to have a plain platinum solution and also a bottle of acid at hand to correct the bath should it prove to be unevenly balanced.

Manufacturers usually advise rather slow toning in the platinum, but there are very few printers who follow the instructions given in this regard. I sup-

pose there are a hundred prints toned in the platinum inside of two or three minutes, to where there are a dozen toned in more than that time. Personally I like to have them go through this bath in a hurry and I have never seen it demonstrated that longer toning gave any better results. I would advise having the bath at a strength where it will tone inside of four minutes. The bath must be strong in platinum. If one dram does not make it work fast enough, keep on pouring it in until the speed wanted is gained. Economy does not enter into the matter at all. It takes so much platinum to do the work, and whether you tone fast or slow, you have got to use just so much to tone your image.

Different manufacturers will tell you that their papers are rich in silver; and then go on and say that the image is extra strong and the paper requires very little gold and platinum to tone it. Don't you believe it. It takes just a certain amount of silver to produce good results, and no manufacturer puts in a grain more than is necessary to produce a paper that will sell. The amount of silver in a gross

of cabinet size paper is mighty small, and the difference in the amount used in two different brands is so small that it can not be considered.

If the print is properly toned in the gold, the whites clear up rapidly in the platinum. The half-tones take on darker tones and the shadows blacken last. An easy method to judge the toning is to hold the print up to the light and look through it. When the red or brown disappears from the deep shadows, it is toned far enough.

If the print has not been toned far enough in the gold to thoroughly clear the whites, the platinum will make them appear muddy. Slight undertoning in the gold will make the print darken slowly in the platinum and a pure black will be difficult to obtain. The tone will be a brownish black, or with some papers (depending somewhat on age) an olive-tinted black.

If toned too far in the gold, the print will tone quickly in the platinum, usually assuming a bluish black color. In most instances the blue tint can be removed by continued toning, but the tone will be more on the gray or olive, than a pure black.

Experience only can teach just how far to carry in the gold, so that the platinum will give the color wanted.

These papers are not suitable for amateur use, as amateurs usually work. One not accustomed to their manipulation will find it necessary to tone many batches before becoming familiar enough with the process to work with certainty. A majority of the professional photographers who use the paper daily are continually in trouble, and that too after the workings of the paper has been demonstrated to them repeatedly.

After the platinum toning the prints must be washed through several changes of water (at least two) before placing in the hypo.

The hypo bath should be fresh and should test about  $18^{\circ}$  by the hydrometer. From ten to fifteen minutes are required to fix the prints.

The final washing must be very thorough. Washing by hand in ten or twelve changes for one-half hour is sufficient. The prints may be mounted directly from the last wash water, by placing on glass and rolling the surplus water out and then proceeding in the

usual manner. If the prints are dried before mounting (which is the safest way) it is policy to flatten them in the same manner as in the first wash water before toning, when wetting them for mounting. They will then lie much flatter and are more easily mounted.

To dry the prints flat, the most practical method is to place them between blotters. It will be found necessary to change the blotters once or twice, to dry them thoroughly. A weight must be placed on top of the blotters to keep them perfectly flat.

There are several so-called single toners on the market, which are intended to simplify (?) the toning of these papers. They are of copper and platinum, and if rightly handled pretty fair results may be obtained. When using them it is necessary to have a stock solution of platinum on hand to strengthen the bath occasionally. Whether a print toned in this manner is permanent I do not know, as I never thought enough about the matter to make an effort to learn.

When the Eastman Company first put the Kodak on the market, they used as advertising matter the words, "You

press the button and we do the rest." They conferred a favor by so doing, as the public were led to believe that photographing was very simple and became interested in it, so that it is now a popular and instructive amusement. Their statement, however, led to a misunderstanding, in that the beginner jumped to the conclusion that the process is much simpler than what it really is. Many purchase a camera with the idea that practically no effort is required on their part. This is wrong. Photographing is a profession, or a trade, depending on the amount of money the worker is realizing from the work. It takes a few years' practice to get the knack of working with average certainty, and even then troubles are always with you.

I once knew an amateur who had a large box in his workroom, which bore the word "Failures" on the label. He was somewhat discouraged, as a friend of his never appeared to make any failures. I advised him to change the label and throw the contents of the box where he could not see it and commence anew. Even if you do make failures, do not worry. A box large enough to hold

the failures of a professional photographer, in his everyday work, would be of such dimensions that a special store-room would be required, if he saved and labeled them all. The showcase contains the "Successes"; the failures are never on exhibition. The case would not hold them. Do not let want of immediate success discourage you. Keep at it, with your eyes open, and you will get there eventually, feeling all the better for the hard knocks.

## CHAPTER VIII.

## DEVELOPING PAPERS.

Professional photographers, as a rule, do not take kindly to this style of paper. The only possible reason why they do not is that they are not familiar with the process of working it. The idea obtains that there is a great uncertainty in working or handling it and that much stock is lost or wasted. This is all foolishness. With a fraction of the amount of experience required to turn out a batch of prints on printing-out paper, the printer can get out his work with practically no loss at all and with great saving of time. I do not exaggerate when I say that I have made hundreds of thousands of prints on this style of paper and, in my opinion, it is unequaled for professional work. A thousand prints a day for a man and a boy is easy. When the work is of a small size and there are many prints from a negative, one man can turn out



double this amount. The professional worker should investigate these papers thoroughly.

For the amateur it is unequaled. Printing as well at night as in the daytime, spare moments at any time may be employed. Any style of finish and any tone may be obtained and the results are permanent.

These papers are made in different grades, and it is essential that the results given by the various grades be understood in order to get the best results. The kind of paper which is generally known as carbon is comparatively slow in printing speed and the print is on the contrasty order. This grade of paper is most suitable for all-around work, especially out-of-door pictures. When the negative is over-timed, foggy or flat, the slow paper will give the most contrast possible to obtain. It is not so good for very strong negatives, as it will probably increase the contrast.

The paper classed as portrait is much faster, requiring shorter exposure. It prints softer, giving full detail. This grade of the paper is most suitable for portraits, interiors and work of that

nature. Very contrasty view negatives will give good results also. The portrait paper is not suitable for average amateur work. It is quite impossible to produce good prints with it from negatives that are thin, lacking in contrast or foggy. A great many amateurs think that because it is labeled Portrait, Special and so on, it is better than the Carbon grades. This is wrong. The fact that a shorter exposure is possible is no argument either, if you do not get the best results that are possible. Get a package of each and compare notes carefully, using the same negative for the test. I have answered hundreds of letters from amateurs, asking why their prints were flat and wanting in contrast. Their conclusion was that the paper was at fault, while the real cause was that they were using the wrong grade of paper for the quality of negative employed.

Both grades of paper should be at hand while printing, so that if one does not give the desired result, the other may be used. The papers are made with all surfaces and are labeled Matte, Rough, Glossy, etc. Each surface can be had with either slow or fast emul-

sion. The finish which one manufacturer may label Carbon Matte, may be entirely different from that of some other maker. For instance, the Velox Carbon has a very smooth surface and the whites of the finished print have a chalky appearance, while the Cyko Carbon is on a much more grainy paper and has a slight gloss. You should try them all and adopt what you think is best. The speed of papers bearing the same grade label, but by different makers, will vary greatly. If you try one make of paper and then another, you must expect this variation in speed. Do not sit down and write a long letter, telling how you find a certain make of paper of greatly different speed from some other you have been using. The maker knows this without being told, and you can rest assured that he makes his paper of a certain speed with some object in view.

The manufacturer, when writing up his advertising matter and direction sheets, tries, for business reasons, to make the working of his paper seem very, very simple. You are told to work so many feet away from the lamp, etc., and the beginner may or

may not follow these directions. If he does at the beginning, he will probably keep hedging closer to the light and soon he begins to have trouble. Just why the average amateur will not use the common sense with this work that he (or she) does with other employment is a puzzler:

The developing papers are very sensitive to light, and to handle them with success some little preparation is necessary to protect them from it. It is very risky to work the paper in a room in which any amount of white light is burning or being admitted from outside. With the fast or portrait paper it should not be attempted. Perhaps many of our readers have worked in this manner and secured results that satisfied them; but I want to ask any who have, to exert themselves slightly in fitting up properly, and after doing so to compare results. Supposing we are printing by an ordinary gas jet and the exposure, with the paper behind a negative is, say, thirty seconds. Now if we open the package, fill the frame and, after exposing, develop the print by the same light, even though we do move back a foot or two, is it reasonable

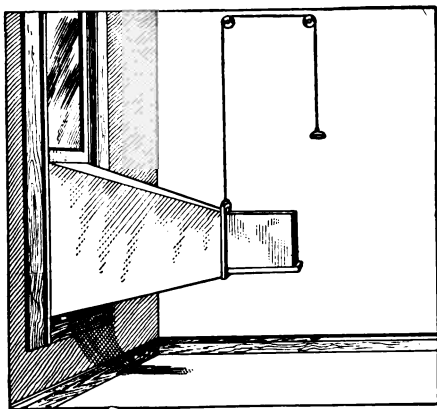
to suppose that we are going to get a print that is perfectly clear from fog?

There are innumerable ways of fitting up for handling these papers safely and rapidly. The main points to be considered are the covering of all lights so that they are of a safe color; arranging so that the printing or exposing may be done without admitting white light into the room and providing a light that does not vary in strength.

When working in the daytime, all windows and openings should be covered with postoffice paper, or yellow curtain material. This may be obtained from all dealers in household goods. It is perfectly safe and is of a color that is easy on the eyes and allows one to see readily just what is going on. The printing light should be so arranged that there is an opening large enough to allow for the size of plate to be exposed. When printing by daylight the simplest method is to make a four-sided pyramid out of some thin material, the larger end of which will cover the bottom sash of the window used. This box should project into the room say from eighteen inches to two feet. The small end should be several inches larger than

the largest negative to be printed from. A square box the size of this small opening and (for an 8 by 10 negative) about a foot long, is fastened to the cone. Where the two join, provision must be made to allow for placing a shutter which may be raised up and down. The front end of this box may be fitted with kits to accommodate different sizes of negatives. To print, place the filled frame against the opening at the front, raise the shutter the required number of seconds and drop it.

The sketch gives the construction of this printing light.



Inside of the square box, just in front of the shutter, there should be strips arranged so that one or more pieces of ground glass may be set to subdue the light as required. The printing window should be on the north side of the building, as the light is more steady. The worker of any experience at all knows that direct sunlight is altogether too strong for this kind of paper. A young gentleman sent in some paper to be tested, claiming that it was defective. He stated that he had printed in the direct sunlight for several hours and the image was just barely visible. He said he had followed the directions. I know that he never read them at all.

It is possible to print this paper in the sun the same as a printing-out paper, but it takes hours to get a strong image and it is flat.

## CHAPTER IX.

## EXPOSING BY ARTIFICIAL LIGHT.

Artificial lights should be well inclosed with a shutter arrangement for exposing. Fittings of this description are only necessary when large quantities of prints are to be made. I would advise the amateur to use the negative darkrooms as much as possible, replacing the ruby light with yellow or amber glass, or yellow paper or curtain linen. Postoffice paper makes a safe and pleasant light to work by. Ruby light is rather too dim to judge development by, as it progresses very rapidly, especially with the slow papers. Filling the frame, developing and so forth, may be done in the darkroom. The exposing light should be outside and should be shaded in such a manner that it can not shine into the developing room. A good rule to follow would be to imagine yourself handling slow dry-plates and work accordingly. If the darkroom is not convenient, the lights



in the room should be shaded with yellow or orange material, arranged in such a manner that part of it will allow of the negative being exposed to the direct light while printing. If the worker will study the matter carefully, before commencing work, there is no reason why there should be failure of any importance. The direction sheets should be studied, not merely glanced over. The manufacturer provides them to help you succeed and the advice they contain is the result of careful study and experience.

The printing-frame is filled in the same manner as with printing-out papers. Do this in a light that you know will not affect the paper. Should you have any difficulty in distinguishing the coated side of the paper, remember that the paper curls toward the emulsion side as a general thing. The emulsion side is generally smoother than the back and with most grades of paper will be more or less glossy.

After filling the frame comes the printing or exposing and this is the very part of the process that savors of uncertainty to those who are not accustomed to working it. No matter

how much experience the printer has had, if he or she attempts to work by a light which is different from the one regularly used, or with negatives of, to them, unknown printing quality, the first exposure will be purely guesswork. The result, whether good or bad, will generally be such that the next exposure will be right. It is always policy to print by the same light so that much uncertainty is avoided.

Artificial lights are steadier than daylight and not so apt to vary. For amateur work the Welsbach gaslight is undoubtedly the best. The light is steady and white enough to affect the paper rapidly and thus allow of very quick exposure. Incandescent electric lights would be my next choice, with ordinary gas as a third. The light from an ordinary oil lamp will also do for printing, but it is rather yellow and affects the paper very slowly, so that the exposures may take minutes. I have made exposures by a kerosene lamp that required twenty minutes. As an experiment I once used a paraffin candle and the negative, of only average density, required over an hour's time to print fully.

The frame should not be held too close to the light when printing or the plate may be unevenly illuminated, with the result of having much less exposure around the edges than in the center. A good general rule is to hold the frame at a distance from the light, equal to the diagonal of the frame.

All lights vary in printing quality and for this reason very short exposures are not practical unless special arrangements are made for very accurate exposing. Using an electric arc light, exposures may be made in a second or two, or even less, but even with a light strong enough to allow of doing so, it is better to shade it with ground glass or tissue paper until the exposure is lengthened to several seconds. Suppose the correct exposure from a given negative is one second by a very strong light. This being so, a quarter of a second more or less would over or under time the print about twenty-five per cent, which is too great a range for most papers. On the other hand, with longer exposures, say ten seconds being just right, a full second, or even more, one way or the other, does not matter much. With the longer exposures it is

possible to shade thin parts of a negative to prevent that part overexposing and developing too dark, or with a different tone from the rest of the print. Very thin negatives should not be exposed to direct light if it is very strong. A better print is secured by covering the negative with ground glass or tissue paper. Blue paper gives very good results.

Developing and developers have been written about so often that it seems that every one should be posted, but I know that there are many who are not. Before beginning the work, read the directions with the paper you are using and then use plain horse sense. Use only the best chemicals you can buy, especially the sulphite and carbonate of soda. I prefer the powdered sodas to the crystal. Do not purchase your sulphite of a druggist in bulk; do not use ordinary washing soda, because you have been told it is identical with carbonate. Buy your sodas in original packages, with a reliable maker's name and guarantee on the label.

I am not supposed to advertise any production, but I want to advise my readers to try Seed's or Mallinckrodt's

guaranteed sodas and save themselves trouble.

Almost any developing agent (excepting pyro) gives good results. In giving formulæ I will quote from various manufacturers' direction sheets, because, although there are many others that are known to be good, there is a tremendous latitude in the proportion of one chemical to another. I give the Velox and Cyko formulæ to illustrate. Either of these developers work with either paper, giving good results. Personally, I prefer the Cyko formula, as I believe it gives more latitude when developing, with any paper. The Velox formula contains too much carbonate to suit my way of working, although that firm evidently get better results with the larger quantity, or they would not have published it.

The Velox formula is as follows:

Water .....	10 ounces
Metol .....	7 grains
Sodium sulphite (crystal).....	$\frac{1}{2}$ oz.
Hydroquinone .....	30 grains
Sodium carbonate (crys.).....	400 gr.
Ten per cent solution bromide potassium .....	about 10 drops

Compare this with the following  
Cyko formula:

Water .....	32 ounces
Metol .....	15 grains
Hydroquinone .....	60 grains
Sulphite soda (powdered) .	1 oz.
Carbonate soda (powd'd) .	$\frac{3}{4}$ oz.
Bromide potassium.....	4 grains

This is the developer which I find the best for any of these papers. It keeps well, does not discolor readily and is the cheapest I know of. I will give others, but this is the one supposed to be used in this demonstration.

Use pure water in making up your stock solution. I use distilled water only and the developer keeps indefinitely. Neither does it discolor much during use. This is bound to occur more or less, but pure water reduces the possibilities of its doing so, materially. The use of bromide potassium or ammonium is absolutely necessary in order to hold the whites clear and to give the image a pleasing tone. The amount given in the last formula is generally sufficient to hold the whites clear, but there may be times when more is necessary. An easy and certain method for testing the developer is to place in it a

small, unexposed piece of the paper to be used and allow it to remain there for at least thirty seconds. If at the end of this time the paper is perfectly white, the developer contains enough to hold the whites in a print. Should the paper assume a motley gray appearance, the developer is not restrained enough and more bromide must be added. Add a drop for each ounce of developer in the tray and test again. One ounce of bromide dissolved in ten ounces of water, or in that proportion, is a standard stock solution. It will keep indefinitely. As the use of bromide is so necessary in negative-making, also, there is no excuse for not having a solution on hand. There seems to be a slight misunderstanding as to what holding the whites clear means. Adding bromide will not give, say, for instance, a white sky in a print, unless the negative is dense enough in that part to hold the paper from printing. Bromide only prevents chemical fog reactions.

The use of bromide in larger quantities influences the tone of the print greatly. A larger quantity than is sufficient to hold the print clear will cause the image to be more or less of the

olive-black order, according to the amount used. Very pleasing tones are secured by increasing the exposure and amount of bromide slightly. Remember that the print loses a trifle of its tone in drying. A print that develops with just a trace of green in the shadows will dry a pure black. This I consider the proper developing color, as it gives the finished print a much richer tone than those that develop pure black. It will have a less harsh appearance and the half-tones will be much better.



## CHAPTER X.

## DEVELOPING.

The tray used for developing must be absolutely clean, and under no circumstances should one be used which has ever contained hypo or mercury. Use plenty of good, fresh developer. Do not attempt to bottle developer after having been once used and preserve it for future use, as it almost always causes trouble. It is possible sometimes to use it the second time, but the risk is very great and it is very expensive economy. If you buy your developer in tubes, accept only that which is prepared by manufacturers of the paper. There are many developers on the market in this form, put up by so-called chemical companies, which, on the average, are worthless. Department-store bargains at 2 cents per tube are pretty expensive in the long run. When speaking of these chemical companies I wish it distinctly understood that I do not include the Chicago Chemical Company,

otherwise known as the "Tolidol People." Every tube of their manufacture which I have tested has given perfect results. I can recommend their goods without any hesitation.

It is no trick to make your own developer, and it is cheaper. Be sure your chemicals are pure. If an ounce of metol seems too large an outlay, get some of your friends to chip in and divide the ounce between you. The same with other material. Amateurs should get together and compare notes, as there is much to be learned in this way. And to the new beginner I want to say, just because some friend has owned a camera one season longer than you have, it does not follow that his or her advice is to be taken as though it were gospel. Listen to all that is told you, but think and observe for yourself. I know a number of amateurs who have been at it for a long time, who can discuss the merits of a lens they never saw, and quote from numberless authorities off-hand to show you that you are all wrong, who positively can not show one decent print of their own make.

Handling the prints in the developer may be done in several different ways.

Most makers advise wetting the print with plain water, and after draining it, pour on the developer. This is a very good method, especially with large prints, but not at all necessary with any ordinary sizes. I never did it except in experimenting, and I have made prints which were eighteen inches wide and eight feet long without doing it. So far as I know these were the largest prints on this style of paper ever made.

It is common practice when developing bromide papers to wet the prints before pouring on the developer, and I suppose the same idea was followed when writing directions for these. If you are using a developer which is too strongly alkaline you may have to wet them, or they will develop with streaks.

Prints may be developed by laying them on a flat surface and applying the developer with a sponge or brush, but this method is not practical, and developer is wasted.

The easiest method I have found is to put plenty of developer in the dish, so that the prints may be covered quickly and evenly. Take the print by one edge and place the opposite side in the solution, giving it a push so that it

will slide in quickly. This will cover it quickly and brush off any air bells.

Every care must be taken that not a trace of hypo gets into the developer, or on the hand that is used for developing. Stains will surely follow. It is easy to use one hand for developing and the other for fixing. The hand used for developing should not be placed in any but the developing tray; not even in the tray used for washing after developing. Take the print from the developer with the hand used for developing and drop it into the wash water. Then grasp it with the other hand and rinse it slightly before placing in the hypo.

If it should so happen that you are using paper which curls when very dry and is therefore difficult to slide into the developer, it should be straightened by laying on a blotter, or clean paper, and drawing a ruler along the back. It is good policy to flatten enough paper (if it is necessary) for the number of prints to be made, before commencing printing.

For the slower or carbon grades of paper the developer should be used full strength, as given in the formula. A

strong developer is necessary with this grade of paper, to give the required contrast and pure black tones. Place the exposed print in the developer, taking every care to immerse it completely. Now watch results. If it flashes up quickly and gets too dark before it can be removed, it is overexposed. Should it develop very slowly and appear weak, it is underexposed. If correctly timed, the image will appear in a couple of seconds. This rule holds good with nearly all the developing papers now on the market. For the rough surface papers, with the slow emulsion, the exposure must not be too long or the print will develop too dark before the developer has worked well into the rough surface. Glossy paper develops somewhat more rapidly than the other surfaces, and allowance should be made for this fact.

Underexposed prints, besides developing very weak, will usually fix out either a blue or gray black, especially if insufficient bromide is used, and forced development in the strong developer will usually stain the whites.

Overtimed prints, besides being too dark, will also have a green or olive-

black tone. Increasing the length of exposure and adding more bromide will change the tone to a decided olive color. The increased amount of bromide will cause development to take place much more slowly than with the normal developer, and when large quantities are used it may be ten or even twenty seconds before the image appears at all. When large amounts of bromide are used in the developer, the image when first appearing will have a rather red color, which will change to an olive as development progresses.

Very artistic tones may be obtained by adding an excess of both an accelerator and a restrainer to the developer. Make a ten per cent solution of carbonate of ammonia and one of bromide of ammonia of the same strength. Equal amounts of each added to the developer will produce very pleasing tones, ranging from olive to sepia and red. The method is good for olive and some shades of brown, but is hardly successful for the sepias, as the whites are not clear and the print will be flat and smoky. The amounts to be used of each, say, in four ounces of normal

developer, range from one-quarter ounce to an ounce. As the amount is increased the exposure must be lengthened also. The larger the amount and the longer the exposure, the more sepia or red will the tone be. The prints develop quite yellow, and dry darker after being fixed and washed.

Development in all cases should be stopped a shade lighter than the finished print is required, as the prints dry slightly darker. It is a good practice to use enough bromide, even when pure black is wanted, to give the image a slight olive tint as it comes from the wash water. It will lose the olive tint as it dries and be a warm black, which is much more brilliant than the blue black caused by not using enough restrainer.

The developer which I have found to be the most practical for sepia tones is as follows:

#### SOLUTION NO. 1.

Hydroquinone .....	144 grains
Metabisulphite of potash.....	72 grains
Water .....	20 ounces

#### SOLUTION NO. 2.

Dry sulphite of soda.....	1 ounce
Dry carbonate of soda.....	$\frac{3}{4}$ ounce
Water .....	20 ounces

Use one ounce of each and five ounces of water to develop. Add a few drops of bromide if necessary.

With this developer the prints must be exposed from three to six times as long as for black tones with ordinary developer. Development is very slow, often requiring several minutes. The prints develop yellow, but dry sepia, with clear whites.

(This formula is copyrighted, and permission to publish must be obtained from the writer.)

The portrait, or fast papers, are handled in practically the same manner as the slower grades, except that much less exposure is needed. The developer may be used full strength, but softer results are obtained by reducing from one-quarter to one-half with water. Prints develop very slowly in the weakened developer, and the bromide must be handled judiciously to prevent staining the whites and to secure pleasing tones.

Among the various developers which I have found effective and practical, the following are a few:



**With carbonate of potash:**

Water .....	64 ounces
Metol .....	1½ drams
Sulphite of soda.....	8 ounces (crystal)
Hydroquinone.....	6 drams
Carbonate of potash.....	¾ ounce

Use one-half water for portrait paper, and sufficient bromide to hold the whites and give desired tone.

**With Amidol:**

Water .....	4 ounces
Sodium of sulphite (dried).....	100 grains
Amidol .....	20 grains

Add from five to ten drops bromide as required.

There are numberless formulæ which give good results, and the worker can certainly choose one from among them which will give satisfaction. I give only those which I have used for large batches of prints and know to be good.

## CHAPTER XI.

## FIXING.

After developing, the prints are dropped into a tray of clear water and rinsed before being placed in the fixing bath. This washing should not be continued over a few seconds — just long enough to wash away the excess of developer which is on the paper. Prolonged washing will often cause the whites to fix out quite pink or yellow, sometimes with a burnt appearance. This wash water should be changed very often. If a small tray is used the change should be made after every dozen prints have been washed, at least. Running water is by far the best. I know of some printers who use a little acetic acid in the water. It would do no harm, but is not at all necessary if the water is kept clear.

When rinsed the prints are placed in the fixing bath, and must be entirely immersed. Just dropping them in and allowing them to float on the surface

will not do at all. They must be stirred about until the hypo has worked thoroughly and evenly into the film. One very serious mistake that many amateurs make is using too small a tray for the fixing bath. An amateur friend of mine had been having considerable trouble with stains which he could not account for, so I called over one evening to watch him work. The first thing he did wrong was to dissolve the hypo by stirring it about with his fingers, using both hands. His prints were 4 by 5 and his fixing tray about one-half inch larger each way. To put half a dozen prints into his tray at one time and keep them properly separated was absolutely impossible. When he commenced printing he held his hands under the tap for a few minutes and dried (?) them on a towel which must have been used for a month without washing. He printed by gaslight and underexposed nearly every print. Being underexposed, they developed very slowly, and to hasten the development he rubbed the face of the prints with his fingers, which, mind you, had been in the hypo. I could not stand seeing paper spoiled in that manner, so I stopped him and asked him to read the

direction sheet and see if he were following instructions. He said he was. Now, I wrote the copy for that particular sheet myself, and I felt positive he had never read it at all, except to get the formula for making up the baths, and I found out that I was right.

A hand that has been in hypo or has touched a print which has been in it should never be put into the developer or touch a print until it is in the wash water after developing. The fixing tray should be large enough so that the prints may be entirely apart. Rubbing the prints with the hand to hasten the developing, or to bring out any particular detail, is absolutely useless, and the chances of staining are very great. You can make a print and rub it all you want to; then I'll use the same solutions and make one without touching it and get as good detail in every part.

The strength of the hypo bath should be somewhat stronger than for the ordinary chloride paper. I get the best results by having it test about  $40^{\circ}$  by the hydrometer. Stronger will not hurt anything; in fact, most makers advise using it as strong as one ounce of hypo to five ounces of water. These prints

fix very rapidly. I have prints made two years ago that were fixed thirty seconds and washed one minute, directly under the tap, and they are good yet. I would advise fixing about five minutes. If prints are fixed too long in a hypo bath which contains alum they are apt to tone more or less, especially if the bath is warm.

All makers advise the use of an acid hardener in the hypo bath, but the advice is not generally heeded. Just why is a question, because the hardener is easily made and certainly costs very little. It is possible at times to fix in plain hypo and luck may be with you for a long time, but sooner or later there is going to be trouble. A few cents' worth of solution will save many a dollar's worth of paper.

The hardener which I use is made as follows:

Water .....	16	ounces
Sodium sulphite (crys.) ..	1½	ounces
Acetic acid (No. 8) .....	10	ounces
Alum (powdered) .....	1½	ounces

This is a stock solution. Use about one ounce of it to each pint of fixing bath. The acetic acid is used to prevent staining from developer that may re-

main in the film or paper. Alum is used to harden the film and to prevent any frilling or blisters. Should this or any regular hardener not be used, alum alone will give the bath an acid reaction, and should be used. The sodium sulphite is to keep the bath clear. The use of the above or a similar hardener is absolutely necessary for large batches of prints. With plain hypo, brown or yellow stains are almost certain to appear, and blisters are quite common. The hardener or even plain alum prevents these troubles.

After fixing, the prints are washed and finished in the same manner as any silver print. The washing should be thorough. Should a blister appear, it may be flattened by touching with a few drops of alum water.

Developed prints are easily toned to several pleasing colors, but to do so without staining them considerable care must be used.

The most successful way is to develop the prints as usual and fix. Be absolutely certain that they are thoroughly washed and that no hypo remains in them. I always dry them and then wash them again before toning.

Hypo-alum toning in a cold bath takes too long and is not practical. The bath should be warmed. The amateur does not always have the chemicals for making up the various toning baths, but alum and hypo are always handy and very fine sepia and browns can be made with these.

Dissolve six ounces of hypo and one and a half ounces of alum in thirty ounces of boiling water and allow it to cool. This should not be filtered. It should be put into some sort of a cooking dish that will not crack when heated. Put the fixed and washed prints into this bath while cool and gradually heat it to about  $110^{\circ}$ . If you heat it too hot the prints will probably tone very weak and instead of a sepia the tone will be yellowish. Tone to the color desired and wash thoroughly. Dark prints should be used in this bath, as they bleach slightly. Allowance must be made for evaporation if many prints are to be toned, and new bath added to keep up the quantity.

Uranium toned prints are very pleasing, but very great care is necessary to prevent the whites from discoloring and various colored stains from appearing.

My experience is that these baths will give good results only when freshly made up. It will be found very difficult to obtain pure whites with solutions that have been put up for any length of time. The bottled goods for sale by the dealers seldom give good tones, because they are too old.

A good bath for browns and sepias is as follows:

SOLUTION A.

Water .....	16 ounces
Alum (powdered) .....	.875 grains
Uranium nitrate .....	82 grains

SOLUTION B.

Water .....	4 ounces
Red prussiate of potash....	18 grains

Pour A into B and shake thoroughly. Place the print, either wet or dry, into this bath and tone until the desired color is reached. Then clear the whites in a bath of an ounce of alum to twelve ounces of water. Give the prints a good washing after the alum bath. It is absolutely necessary that all hypo be washed out before the prints are put into this bath, or stains will result.

Another bath which gives practically the same results is made as follows:



Water .....20 ounces  
Red prussiate of potash....20 grains  
Acetic acid, C. P..... 1 ounce  
Uranium nitrate.....20 grains

The whites, if not too badly discolored, may be cleared by washing in running water, but generally the alum clearing bath or a weak solution of acetic acid is necessary. I have heard of a weak solution of sulpho-cyanide of ammonia being a good clearing bath, but can not say that it did well with me.

For blue tones three solutions are necessary, and as the keeping quality of the bath is very poor, they should be combined just before use.

## A.

Citrate of iron and ammonia.....100 grains  
Water ..... 2 ounces

## B.

Red prussiate of potash..... 50 grains  
Water ..... 1 ounce

## C.

Nitric acid, C. P.....200 minims  
Water ..... 4 ounces

Combine these in the order named. Tone to the desired color and wash in clean water until the whites are clear.

This bath tones very rapidly. The toning should be done in a weak light, as the solution is sensitive. The addition of 100 grains of uranium nitrate to the above bath will give a green tone, but it is difficult to wash the prints without bringing them back to the blue. There are numberless methods for developing and handling these papers to produce different results, and I could go on and fill many pages more, but the formulæ I have given will produce any print that is possible, so it would be needless.

There need be no failures if care is used. I want to impress on the beginners, and caution some of the older workers who grow careless, that absolute cleanliness is necessary to success. Chemically clean trays, a new towel occasionally, and so on, will soon prove to you that many troubles are of your own making.

## CHAPTER XII.

## PLATINOTYPE.

Of all the printing methods that are within reach of the amateur, there is none, in my opinion, which can begin to compare with platinotype. Carefully made, a print by this process is a joy forever. The printing and finishing is simplicity itself, and of its permanency there is absolutely no question. If you have never made a print on this paper, because you have heard that its manipulation is uncertain, my advice is to get a package as soon as you can and commence now. It is as simple as making a blue print; in fact, it is a near relation of that old-time friend.

It must be understood that I offer this advice only to those who have progressed far enough in photography to produce a negative of good printing quality. The best negative is one that is fully timed and developed to good

density. The shadows must be free from fog. Thin negatives, whether from over or under exposure or insufficient development, or negatives which are foggy, will not make a print on this class of paper.

The amateur of only one season's experience, unless having the benefit of instruction from a practical worker, had better not attempt platinum printing, as the probabilities are his efforts will be failures, due to poor negatives.

The papers on the market at present are of two kinds — that known as the cold-bath platinotype, and the other known by pretty much any old name, such as water development, water-tone or something of the sort. I will say a few words about this last-named class of paper before proceeding with the platinotype paper. These water-developed papers are platinum, all right, and if luck is with you and you get a good print, the product is as permanent as with the better grade of paper. It is possible, too, to make very fine effects. The paper works somewhat more contrasty than the development process. The developer is incorporated with the sensitizing salts and on this account the least

trace of dampness will create a reaction during the printing, which makes that operation rather uncertain, varying according to the amount of moisture present.

If the paper is properly packed in a sealed can and has been kept in a cool, dry place until wanted for use, the color of the sensitive side will be a lemon-yellow. If taken from the can on a warm, dry day and printed behind a negative which is perfectly dry, the image will appear quite rapidly and will vary in color from a deep brownish yellow in the shadows to a rather slaty color in the half-tone. Under these conditions the printing should be carried to a point where the detail in the high lights becomes visible. As soon as printed, the paper should be plunged into water of about 120° temperature and allowed to remain until the whites are quite clear. This generally requires about thirty seconds' time. When developed, the print is placed directly into a clearing bath of muriatic acid and water (1 ounce of acid to 60 ounces of water) until the yellow color has entirely disappeared. The prints are then washed in plain water for five or ten

minutes to remove the acid, and then dried or mounted.

This is the process of printing and finishing as generally given in the directions which come with the package, and is correct if the paper has been kept perfectly dry, but when the atmosphere is damp the results are not as described. The image, instead of printing the proper color, will print out, that is, will appear fully and be of a black color. I have opened fresh cans of this paper, in ordinary weather, handling it as carefully as possible, and found that almost every sheet in the package printed differently. The first one or two would print nicely, but the last few sheets, having been exposed to the atmosphere for an hour or more, had attracted so much moisture that they printed out fully. It is this sensitiveness to moisture which makes the paper uncertain and impracticable.

The most certain manner which I have found to produce a print is to steam the paper slightly before putting it in the frame. It will then print out and the depth of printing can be judged accurately. The tone of the finished print will not be black, but of a brown-

black color. It is very pleasing at that and if pure blacks are not the object, the prints are fairly satisfactory. When paper is steamed in this manner, it is usually not necessary to develop it at all. Place it directly into the acid cleaning bath as it came from the negative, and when the whites are clear, wash as above described.

I would not advise any one to use this kind of paper. It is manufactured for sale to the amateurs, and I am bound to say that it is my candid opinion that all manufacturers do not take as much care in the making as they know to be necessary. Another word of advice I would give the amateur is, to use the papers which professional workers use. There are several varieties of different papers on the market which are advertised as being unusually simple of manipulation. It will not pay you to fool with them. Learn to print a practical paper at the beginning.

Platinum paper is so easily affected by moisture that it is packed in sealed tin tubes, from which all moisture has been expelled by means of heat. Each can contains a package (in some form) of calcium chloride, which is usually called

the preservative. Calcium chloride attracts any moisture very readily and is placed in the can for that purpose. If at any time you should use a part of the paper in the can, heat the preservative to expel all dampness and drop it into the can quite warm (not hot) before re-sealing it.

Platinum paper is also affected by heat and should be stored in a cool place. The upper part of a refrigerator is a good place. It should not come in contact with the ice or water. During very hot weather I do not believe I would buy from a dealer who kept the cans on a shelf. He should have an ice-box.

It is generally advisable to print platinum in a good light, either under ground glass or with the frame covered with tissue paper, but this is not absolutely necessary, as just as good results are obtained in direct sunlight if the negative is fairly dense. With thin negatives the printing must be done in a weaker light. Bear in mind that platinum prints very rapidly and if handling several negatives, in direct sunlight, watch them carefully or you are going to lose paper from overprinting.



Before placing the paper on the negative, the latter should be thoroughly warmed and dried. The printing-frame, especially the folding back, should be warmed also, to be sure there is no moisture in the cloth covering. If this is carefully done there is no need of using rubber or celluloid pads. Paper manufacturers advise the use of these pads in all cases, but not one printer in a thousand ever bothers with them, although they are a very good thing to use as a precaution. If you have not time to dry your frames, however, the use of a pad is absolutely necessary if you desire a brilliant print.

Both the negative and the paper should be carefully dusted before the frame is filled, as, aside from the white spots left on the print by particles of matter being between it and the negative, these same particles may be the cause of comets in the finished print. A negative for platinum printing should be varnished to cover all traces of hypo or other salts which might remain in the film. Rub the negative thoroughly with a wad of pure cotton before placing the paper against it.

A negative which has been strength-

ened with mercury is worthless for platinum printing unless it is varnished clear to the edges.

Platinum paper is rather expensive compared with silver paper, and the worker will not care to waste much of it, so it will be necessary to use every precaution possible. The few points just given will prevent most failures, if followed.

The sensitive surface of the paper is of a lemon-yellow color, and this side, of course, is placed next to the negative. The image will appear quickly when the frame is set in the light, and will be fully printed in probably one-third the time required for a silver print.

Each can of paper contains a direction sheet with a picture in yellow and black showing how the print should appear fully exposed. Let it be your guide for the first print, and after that first one is made the rest are easy if you watch the results carefully. If the print, when developed, is too dark, do not print so far the next time; if too light, print deeper. It will be useless for me to describe the appearance of the print, as the directions do it plainly by means of the colored picture, and the first print

you make will tell you the whole story. When it is necessary to print from a thin negative, however, it will be found that the image should not appear too fully. In some cases just allow it to appear before stopping it. It will develop out all right. Prints from thin negatives will generally be gray in tone, unless overprinted, and then the detail will be lost.

Prints should be developed as soon after printed as possible. This is especially necessary on a damp day. On a dry, warm day it is not so necessary.

## CHAPTER XIII.

## PLATINUM DEVELOPING.

A saturated solution of potassium oxalate is the standard developer for platinum papers, but to obtain various effects other salts are added in varying proportions. Plain potassium oxalate makes a very good developer, but for the colder tones which most printers prefer, the addition of phosphate of potassium or sodium is necessary. I have heard that the potassium is the better, but can not see any particular difference. A good all-round developer is made by dissolving twelve ounces of potassium oxalate and four ounces of either phosphate in about fifty ounces of hot water, and allowing it to cool. Filtering will not be necessary, although it is just as well to remove any matter which might adhere to the print. With different makes of paper it may be found advisable to increase the proportion of the phosphate, and again a

smaller amount may give the tone you want.

When printing from negatives that are inclined to give a flat print, the addition of a few grains, or in some instances quite a quantity of sulphate of potassium, to each ounce of the developer, will help in securing more contrast. The printer should experiment with different proportions of the various salts until a combination is secured which gives the desired results.

For good results the developer should not be used below sixty degrees in temperature. If the developer is too cold, the prints will probably be weak and granular. The temperature of the bath has much to do with the tone, heat increasing the tendency toward the brownish blacks. Old developer, that is a solution which has been used, gives better results than one perfectly fresh, and for this reason the used developer should be saved and used repeatedly, adding fresh solution occasionally to keep a sufficient quantity in the tray. Economy in the quantity of developer used is expensive, as the dish must contain enough so that the print may be quickly covered.

Underexposed prints may be saved by raising the temperature of the bath, or by removing the print from the developer and holding it against anything that is hot, but the tones will suffer.

The best way to place a print in the developer is the way you can get it covered quickly, without air bells forming on the surface. Taking it by one edge and sliding it in face up is about as handy as any, and any bubbles can be seen and brushed away. Develop until the print is just a shade lighter than the finished print is desired. It will dry a trifle denser than it is while wet.

When developed, the print is placed directly in the acid clearing bath. This bath is of one ounce of chemically pure hydrochloric acid in about sixty ounces of water. To be absolutely sure of pure whites, three acid baths should be used, all of the same strength. Leave the prints in each bath for probably five minutes and then wash in clear water for a quarter of an hour to remove the acid. The last acid bath should not show a trace of the yellow color. If it does, use four baths, or else change the old for fresh ones.

These simple directions are all that are necessary to be followed to produce platinum prints in black and white. Troubles will appear, however, and a few of them we will consider. Generally the amateur gets into trouble by using negatives unsuited to this kind of paper. Nothing but experience will teach him to leave weak negatives alone.

Overdeveloped prints will be too dark and underprinted ones too light. It is theoretically possible to strengthen or reduce them, but it is not practical, and a new print is cheaper and more satisfactory. Yellow whites are caused by not clearing sufficiently in the acid bath.

White comets may be from a number of causes, such as dust or dirt on paper or negative, but in my experience they are generally due to defects in coating. With this paper it is about impossible to avoid them entirely and the printer must expect to have them appear occasionally. The best remedy is a spotting brush and india ink. Absolute cleanliness will prevent most of the spots and other small defects.

I do not like to say a word about sepia and red tones on platinum paper, because, until the printer has had experi-

ence, he is going to have trouble. If they must be made, use the paper recommended for that purpose. It will contain mercury, and, if used as directed, then very fine results may be obtained. The plain oxalate of potassium developer (a saturated solution) or the oxalate phosphate solution may be used for developing sepias and reds, but it is necessary to add various amounts of bichloride of mercury and also to vary the temperature of the developer for the different tones. My advice is to let mercury alone. Mercury-developed prints are uncertain and altogether unreliable. The trays used for mercury solution can not be used for black tones afterward without taking chances.

The following table will be found a good base for experimenting on how to secure various tones with platinum paper:



No.	Paper.	DEVELOPER.					Tempera- ture of Developer.	Result.
		Potassium Phosphate.	Potassium Oxalate.	Mercury Bichloride.	Citric Acid	Water.		
1	AA	½ ounce	½ ounce	.....	.....	5 ozs.	Warm, 70°	Warm black.
2	AA	½ "	½ "	.....	.....	5 "	Hot, 170°	Warmer black.
3	AA	½ "	½ "	.....	.....	5 "	Hot	Brown black.
4	CC	½ "	1 "	30 grains	.....	5 "	"	Cold brown.
5	CC	.....	1 "	30 "	.....	10 "	"	Warm brown.
6	AA	¼ ounce	½ "	30 "	10 gr.	10 "	"	Cold sepia.
7	AA	.....	1 "	Abnormal quantity	.....	10 "	"	Brick red.
8	CC	Company's	D salts	30 grains	.....	1 pint	"	Rich brown.
9	CC	Company's	One ounce D salts	30 "	.....	1 "	"	Sepia.
10	RS	½ ounce	Two ounces	30 "	10 gr.	5 ozs.	"	Warm brown.
11	RS	½ "	1 ounce	.....	.....	5 "	Warm	Rich brown.
12	RS	½ "	½ "	.....	.....	5 "	Hot	Purple brown
13	RS	½ "	½ "	30 grains	.....	5 "	"	Sepia.
14	RS	½ "	1 "	30 "	.....	5 "	"	Warm sepia.

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BY J. EDGAR ROSS.

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# BEGINNERS' TROUBLES.

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## CHAPTER I.

### DEVELOPING ROLL FILM.

A film differs from an ordinary plate in the fact that the silver salt is coated on a thin film of celluloid. The advantages of films lie in their great lightness and in the fact that as they can be rolled up they occupy very little space. To the tourist they are of inestimable advantage, and have many points to recommend them to the ordinary worker. Hence their great popularity.

The first noticeable point about a film when one proceeds to develop is its tendency to curl when first placed in the water, but this is a trouble easily got over by permitting them to soak for a little in clean water. But I would like to draw particular attention to a more important feature, too often neglected. In holding a glass plate up to the lamp for examination we grip it by the edge so that our fingers do not touch the film at all. But, in handling films,



we must catch them between thumb and forefinger. Now, the temperature of the body is above the melting point of gelatin, and the result is that, in hot weather, even although the baths may be fairly cool, if we hold a wet film but a little while the gelatin will probably melt where the thumb touches it. A glass plate caught the same way would hardly be harmed, as the heat would be absorbed by the glass.

Another trouble is frequently the lack of suitable developing trays. Very often platters or soup plates are pressed into service, and, if they are large enough or the films are small enough, they serve the purpose admirably.

These troubles may all be avoided by the following method of handling films:

Take two strips of soft wood 3 feet 8 inches long, 1 inch wide and not more than  $\frac{1}{2}$  inch thick, and two 4 inches long  $1\frac{1}{2}$  inches wide and 1 inch thick. Plane them off smooth if you have a plane; if not, scrape them smooth with a pocketknife or piece of glass. From each end of the small pieces cut away one inch half through the board so that the ends of the long pieces will match into the cut-out place. Fig. 1 shows the

stick after being cut. Fasten the ends of the long strips in position with several small screws or shingle nails at each

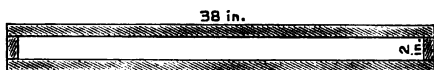


*Fig. 1*

end. This will make the long strips two inches apart and the frame will look like Fig. 2, except that the proportionate length has been greatly reduced to save space. Brush both sides of this frame with melted paraffin and "burn" it in with a smoothing iron just hot enough to melt the wax. The dimensions here given are for a frame to develop a roll of twelve  $3\frac{1}{2}$  by  $3\frac{1}{2}$  films. If your camera is smaller you can make the frame to fit the film. If it is larger this method of development will hardly be practical unless you cut the film in two.

From another  $\frac{1}{2}$ -inch board 3 inches wide cut two pieces the shape of Fig. 3, and around the wide end wrap a 3-inch

strip of old white muslin. A worn-out bed sheet or "any old thing" will do if it is only soft and free from color that will run. One edge of the cloth should project about two inches from the end of the stick and it should be wrapped around ten or twelve times, so as to form a thick swab. Then fasten it in position with a rubber band or string.

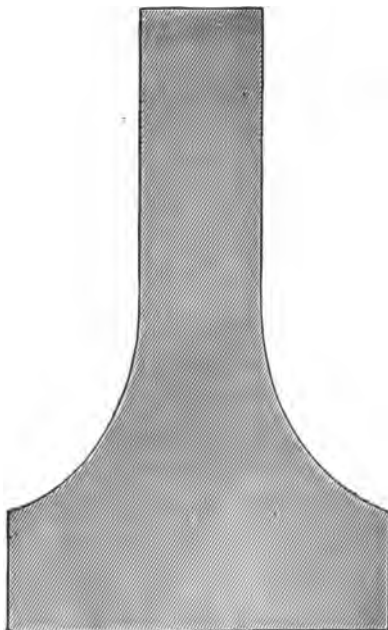


*Fig. 2.*

Write "Developer" on one and "Hypo" on the other, so as not to get them mixed.

When you are ready to develop, pour your developer into a deep earthenware dish and the fixing bath into another. Fasten one end of the film to the frame with three or four thumb tacks pressed through the film near the edge and quite deep in to the wood. Unroll the film and fasten the other end to the other end of the frame in like manner. Place one end of the frame in the developer and hold the other end almost upright with the left hand, while with the right

you wet the swab in the developer and draw it quickly and *lightly* up and down the entire length of the film. Do not stint the developer, but let the swab take



*Fig. 3.*

up all it will carry. After the film has been thoroughly wet, the end that is held in the hand may be lowered so that the developer will not run down so rapidly, but it must always be held high enough to keep the developer from dripping off at the sides instead of running back into the dish as it should. The ends may be reversed occasionally, and as two inches of the film can be seen along its entire length, the progress of development may be watched without touching the film. When the development is completed the films may be fixed in a similar manner, but be careful to not use the developing swab in the hypo.

If the fixing bath is double the usual strength it will save time, and I advise you by all means to mix a fresh bath every time you fix. Hypo is too cheap to economize with and fresh hypo hardens the film so that there is less danger from accidental scratches.

The film may be washed without removing it from the frame by simply floating it, film down, in a mill pond, horse trough, bath tub or anywhere that water enough can be had to float it. Failing that, it may be washed under a

hydrant from which the water is allowed to flow very gently.

When thoroughly washed, the film should be swabbed for a few minutes with the glycerin bath and hung up or stood on end to dry. After the film dries it may be removed and cut. Theoretically many objections may be made to this method of handling film, but actual practice will demonstrate its practicability. It is true that each film will receive an equal development, but if any are overdeveloped they may be reduced by a very simple ferricyanide bath. There is not much hope of forcing up an undertimed film by development so prolonged that there is danger of fogging the good ones.

Do not be afraid that getting hypo on your frame will spoil it for the next developing. If it has been well coated, a few moments' washing will remove every trace of hypo.

By this method one need not touch the film until it is dry, and among other advantages is that it will permit the use of pyro without the usual accompaniment of stained fingers.

## CHAPTER II.

## IN THE DARKROOM.

The darkroom, developing formulæ and finger-staining chemicals have frightened many an amateur into taking his plates to a professional photographer for development. Of course, we are not all built alike, and some may be so constituted that darkroom work, even though understood, would be quite disagreeable. But to me it is by far the most interesting part of the art.

Some hesitate to undertake their own developing because of the lack of a darkroom and suitable appliances with which to work. There is a great deal of satisfaction in working in a well-fitted-up darkroom; but it is surprising how little one can get along with in a pinch. Many a time I have gone to my room in a hotel and, by closing the blinds and hanging a blanket over the window, improvised a darkroom. The wash basin would serve for a fixing

bath, the slop jar for a washing tray. I would then make a darkroom lantern by rolling a double sheet of postoffice paper into a cylinder, pinning it in that form, and setting it over a lamp or candle. Then I was ready to develop in the tray I usually carried, though I have improvised a developing tray by lining a plate box with glazed writing paper. Now, I do not advise my amateur friends to be satisfied with such apparatus as these. I simply want to show what a little patience and ingenuity can do.

If one lives at home there is usually a closet that can be made into an excellent darkroom. Failing that, the kitchen or bathroom could be used, and the developing done after dark. But it is my purpose in this article to make some suggestions on how to work in a darkroom, not how to make one.

To begin with, I want to say a word about cleanliness. The darkroom should be the neatest, most orderly place imaginable, but far too often it is just the reverse. Everything that ought not to be seen is thrown into the darkroom, where the light is not so apt to show up the untidy corners. Empty and half-empty bottles are left standing around



promiscuously. Sometimes they are labeled, but more often not. Developer, hypo and various other solutions are spilled upon the floor and left there to dry. The chemical dust thus left on the floor is kicked up by shuffling feet and settles in the plateholders and trays, on the plates, in fact everywhere. If you are ever troubled with pinholes in your negatives, try cleaning out your dark-room, as well as dusting plateholders and camera, and see if the trouble does not disappear.

I do not know that it will be possible to say anything new about developers. Every photographer has his favorite. Perhaps the majority of professionals still cling to the good old pyro, and for their use it has hardly been improved upon. Amateurs do not take so kindly to pyro and, where few plates are developed at a time, and perhaps none at all for a week or two, it has some drawbacks when mixed according to most formulæ.

Here is my favorite developer for all-round purposes. It is one that keeps well, but if it is to be used slowly it is best to store it in several small bottles filled to the neck and tightly corked.

It may be used repeatedly — until it gets too weak to act.

Water .....	80 ounces
Metol .....	$\frac{1}{8}$ ounce
Sulphite soda.....	4 ounces
Hydroquinone .....	$\frac{1}{2}$ ounce
Sal soda.....	6 ounces

For Velox paper I use this developer full strength, and to each ounce add a drop of a fifteen per cent solution of salt. For lantern slides and transparency plates it should be diluted with an equal amount of water and from four to ten drops of the salt solution added to each ounce. For plates, normal exposure, I use two ounces of developer to three of water. About the correct proportion for bromide paper is one ounce of developer to two of water.

With any developer it is better to vary the quantity of water than to alter the proportions of chemicals to correct a faulty exposure or modify the character of the negative. For an undertimed plate use more water; if it is overtimed use less.

Right here I want to say a word about under and over exposures. You are sure to get them sometimes; apt to get them often. For that reason it is impor-

tant that you be able to recognize them, and here are two simple methods by which they may be distinguished.

In developing an underexposure the high lights will appear quickly and develop up strong and vigorous, while the shadows are still clear glass. An overexposure will slowly darken all over the plate and will show little or no detail as you look down upon it in the developing tray. If the plate has been properly timed the high lights will appear first, but they will be quickly followed by the half-tones and shadows, and all will acquire proper density together.

The other method is to take the negative after it is dry, hold a black cloth behind it, and look at it by reflected light. If it shows a positive best on the film side it is undertimed. If the positive is better on the glass side it is overtimed. If neither side shows a positive, or if it is equally good on both sides, the exposure has been correct.

For a fixing bath there is nothing like a freshly mixed solution of plain hypo. About one part of hypo to four parts of water is the correct proportion, but in warm weather it may be used much stronger. Alum may be added to the

fixing bath and it has a tendency to keep the bath from discoloring, as well as to harden the film. But hypo will not discolor with one batch of plates, and, as it costs so little, it is poor economy to use old fixing bath. Fresh hypo is itself a hardener, and under ordinary circumstances no other will be required.

I have often developed, fixed and washed my plates in one and the same tray. This may be done with safety if one is careful to wash the tray thoroughly after using it for hypo. But trays should *always* be washed before being put away, no matter what has been used in them.

## CHAPTER III.

## A FEW PRINTING TROUBLES.

Amateur photographers often complain about their gelatin prints fading and taking on a pale yellowish or greenish tone. In nearly every case the trouble is caused by the use, or rather the misuse, of a combined toning and fixing bath. The surest way, in fact, the only *sure* way, to avoid the trouble is to taboo the combined bath.

There is hardly a photographic magazine published that has not, at one time or another, lent its columns to a denunciation of the combined bath. But the combined bath continues to be used. The reason for this is its ease of manipulation, and with a certain class of professionals, who travel about from place to place photographing everything where they think a print will sell, its cheapness.

They, of course, don't mind if the prints do fade. I once expostulated with a photographer of this class for the

way he handled his prints, but he closed my mouth by quietly informing me that they would last until he left town.

No amateur would offer such an excuse as that, but the ease of manipulation catches many of them. Where one makes but three or four prints at a time it is easier to take them directly from the printing-frame to the toning bath and finish by washing under the hydrant. But no one need expect to find excellence living on easy street.

Again, many beginners do not know what a treacherous thing a combined bath is, and it may take them a year or so to find out by dear experience.

Those who have been in the habit of using the combined bath should, in changing to the separate, be careful to closely follow the directions given with their paper. The combined bath may be so greatly abused without showing any immediate signs of protest that its users are apt to get careless. A friend of mine, whom I persuaded to try the separate bath, complained the next time I met him about his prints being covered with pale green blotches. The prints appeared to have been insufficiently washed. But he assured me that

they had been washed an hour in running water, and I was at a loss to account for the trouble until I found that he put his prints to wash under a faucet and gave them no further attention until the washing was finished. This plan worked all right with three or four prints, but he did not want to waste time toning so few in the separate bath, so he waited until he had twenty-five or thirty. That was right, and had he kept the prints in motion during the final washing he would have had no trouble. This he failed to do. As the prints soon settled to the bottom of the tray, the water surrounding many of them remained practically unchanged. The result was that fully two-thirds of them were ruined.

Those who use developing paper seldom have troubles of this sort, but they often have a hard time to get the correct exposure. The manufacturers usually advise the testing of each negative by printing and developing a narrow strip of paper. This, indeed, is the only safe way until one has sufficient experience to see at a glance what exposure a negative will require.

The strength of daylight varies so

greatly that it is much better to print by some artificial light. It does not matter much about its source. It may be a candle or an electric arc, but the printing-frame should not be held too close to the light, as the center may receive more light than the edges. A foot from the light is a safe distance if the negatives are not larger than 5 by 7. A good plan is to print your densest negative at that distance and when you have found by testing how long it takes to print, use that as a "standard" printing time. The thinner negatives may be printed in that time by simply moving them farther from the light. By this plan much testing will be saved. When once the proper distance from the light is ascertained, it should be recorded in the book you *ought* to keep to record everything of interest about every negative; or it may be written on the film of each negative with a lead-pencil.

In following this plan, it is well to remember that the strength of light decreases in the same ratio that the square of the distance from its source increases. If three negatives are placed respectively one, two and three feet from the light, the second will receive



one-fourth as much and the third one-ninth as much as the first.

Another trouble that all amateurs have is to keep their collection of pictures intact. "The only way I could keep my prints would be to paste them onto the house," an amateur said to me not long ago, "and then I'd be afraid my friends would tear off the boards and carry the house away in pieces." Besides this, where one has a large collection of prints, whether mounted or not, they are not easily handled, and it is quite impossible to keep them in order. Of late albums have been getting quite popular, but their expense keeps them out of the reach of many. An excellent plan is to make your own albums by printing each picture on a sheet of paper somewhat larger than the negative, leaving a white margin all around the print, and binding them together between stencil-board or even bristol-board covers. For 4 by 5 negatives paper not smaller than 5 by 6½ should be used. This will give a little more than half an inch of margin all around the print, with an extra half inch at one end to be used in binding. At the wide end three holes should be punched, so that the

prints can be laced together with a shoe-string or ribbon.

Albums made in this manner are not so bulky nor expensive, and in my mind are much neater than anything you can buy.

## CHAPTER IV.

## EXPOSURE TROUBLES AND HOW TO AVOID THEM.

Some time ago I had a young man coming to me at regular intervals for instructions in photography. To begin with I would send him out to photograph different objects, always telling him what stop to use and what time to expose for each. Then he began to select his own subjects, and when he would describe them and tell me at what time he expected to take them, I would give him the number of the stop to use and the required exposure. During the time he followed that plan he never made a failure. His negatives were bright and clear and snappy in every respect; as good as my own. Of course it ought to have been so, for he had the knowledge I had gained during several years of experience and study to draw upon.

But when I sent my pupil out to select his own subject and use his own judg-

ment about stops and exposures, his troubles began. For a long time after that poor negatives were the rule, and good ones the rare exception. In nearly every instance the trouble was in the exposure. Of course he was surprised at his repeated failures, but I was not; for when I sent him out to use his judgment about exposure I knew that he had none to use.

Judgment is that faculty that enables one to arrive at conclusions by comparing known facts or past experiences. If one has no past experience and is unacquainted with facts relating to a subject, it follows that he can have no judgment in that particular matter.

My pupil improved with practice, just as every one does. But to get the proper exposure was his greatest trouble, and he once said to me: "I wish I had about ten years of experience put up in portable form, so I could carry it around in my vest pocket and consult it whenever I wanted to make an exposure." It was not laziness that prompted that wish but simply a desire to profit by the experience of others, which was perfectly right.

I thought at the time that a carefully

compiled table, giving the necessary exposure for different subjects, with different stops, under the varying conditions of light and with different brands of plates and films, would make correct exposures as easy for the novice as for the photographer who had years of experience behind him.

My time was occupied with other matters at that time, but I resolved "at a more convenient season" to compile and publish such a table. But when that convenient season came I found that others were ahead of me and so I let the matter drop. Since I began this series of articles, however, I have had the matter repeatedly brought to my mind; for fully one-half of the beginners' troubles that have come to my notice are caused by incorrect exposure of the negative. A very large proportion, if not all of these mistakes, could be avoided by consulting a carefully compiled exposure table.

Several such tables are published, but I never used one nor even carefully examined one, so I am not in a position to say this one is correct or that one is not. \* But this I will say; any practical photographer with good horse sense

*could* compile exposure tables. The "Photo-Beacon Exposure Tables" were compiled by such a man, and on the strength of that fact I have recommended them to several beginners with whom I am acquainted. The properly timed negatives they have afterward shown me testify more plainly than anything they could say to the accuracy of the tables.

Some of my readers may think that exposing by rule will be too mechanical to be artistic; but nothing could be farther from the truth. The place to display one's individuality is anywhere but in making the exposure. A certain subject in a light of certain intensity requires an exposure of a definite time. Give it more time and your negative will be overexposed; give it less and it will be underexposed. Any variation in subject, light, stop or sensitiveness of plate, demands a definite alteration of the exposure. The whole thing is mathematical, and though artists may be born, mathematicians are certainly made.

I know of no reason why a beginner should make so many faulty exposures when such a help has been placed within

his reach. It is certainly poor economy to be without the tables, for if they save half a box of 4 by 5 plates it will be a paying investment financially, to say nothing of the satisfaction it will give to be able to get bright, clear negatives every time.

## CHAPTER V.

## PAPER FOR BEGINNERS.

The most suitable paper for a beginner to use, is the one most simple to work. If his negatives are all good and plucky, that will be blue-print paper. But the *sine qua non* of a good blue-print is a good negative to make it from. Gelatin print-out paper is simple enough, and it is often possible with it to get a passable print from a negative that would be a complete failure if printed by any other process. Self-toning Aristo is equally good for such negatives, and it is still more simple; so simple indeed that there is almost nothing to learn.

Whatever printing process is chosen it should be thoroughly mastered before another is undertaken. It is best also to stick to one brand of paper until you know how to use it. By the time you have gained a knowledge of the peculiarities of gelatin paper you will have some favorite negatives that you



- will want to see printed on some other paper. Vinco, Velox, or some similar paper ought next to be taken up. When each of the more common printing processes have been mastered, the ambitious photographer will be in a position to judge for himself which is the most suitable for each particular subject or negative.

#### FLASH-LIGHTS AND FLASH-POWDER.

The peculiar staring expression in the eyes of a flash-light portrait one often sees comes from making the exposure after the sitter had been for some time in darkness. In the darkness, or even in a very dim light, the pupils of the eyes soon become dilated and the eyelids are unconsciously opened wide to catch the faintest beam of light. If we could see the eyes of a person suddenly brought from darkness into a bright light, they would have the expression complained of by our correspondent. The remedy, of course, suggests itself. Simply do not extinguish the light by which you arrange your sitter until the exposure is made. You need have no fear that the light will

affect the plate unless it is actually included in the picture. An electric arc, if a reasonable distance from the sitter, will hardly make an impression on the plate during the few seconds it may be necessary to expose it before making the flash.

In my note-book I have a number of formulæ for flash-light powder. All are good, and one has never been published, so far as I know. I also have four eyes, two of which I did not need before I mixed flash-light powder. But I am very fortunate to be able to see even with glasses, so I am not going to complain. Neither am I going to publish that formula which I worked out with such care. The powder was perfectly safe, however. I repeatedly ground it in a mortar (in small quantities, of course), just to prove that it was harmless. But when I mixed four pounds of it, and had half a pound bottled up, the remainder exploded without cause except the perverseness of its own disposition. One of the four brick walls surrounding me was pretty well braced and it withstood the shock, while the other three gave way and the roof took wings. To that solid wall

I owe my life, for I stood between it and the powder, and the force of the explosion went every other way. To prove that the powder was perfectly safe and wouldn't burn except when it was wanted to, I may add that the bottle containing the other half-pound was picked up among the debris when the workmen, several weeks afterward, were preparing to rebuild the house. The bottle was unbroken and the powder as good and harmless as ever.

#### STAMP PICTURES.

When most of the regular studios are making stamp pictures at twenty-four for 25 cents, it would seem that this class of portraiture should be left in the hands of the professionals. Of course, no one will want to take them for profit, but one reader of the *THE PHOTO-BEACON* asks if his camera can not be fitted to take them, as he wants an economical way of practicing. This is quite an easy matter. Suppose the camera is a 4 by 5 and you want to take six positions on a plate. Remove the ground glass and draw a line across it, on the rough side, of course, with a lead-pencil, separating it into two

sections, each 2 by 5 inches.  $1\frac{3}{4}$  inches from each end draw another line at right angles with the first. That will divide the ground glass into six sections. The middle two will be  $1\frac{1}{2}$  by 2 and the others  $1\frac{3}{4}$  by 2. A quarter of an inch may now be spared all around the plate and still the stamps will be  $1\frac{1}{2}$  by  $1\frac{3}{4}$ . Next make three slides of thin dark cardboard and mark them like the ground-glass, to take the place of your regular slides. Now cut out one of the six sections of each of these slides. The lower right-hand corner of one; the lower left-hand corner of another; and one of the middle section of the third. Next mark the glass of your finder with a diamond or a delicate line of oil paint, dividing it into six sections corresponding to the ground-glass. These marks will in no way interfere with the use of your camera for other work, and the only apparatus you will need for the stamps is the three cardboard slides.

When you come to make your stamp negatives, let the image of your sitter occupy one, say the lower left-hand, section of the ground-glass. Place the plateholder in position, draw the neg-

ular slide, and insert the cardboard slide having that section removed. Make the exposure in the regular manner. Now, with the aid of the finder, adjust your camera so that the image will fall upon the upper left-hand section of the plate, reverse the cardboard slide, and make the second exposure. The other exposures are made in a similar manner, each slide serving for two negatives.

## CHAPTER VI.

## PHOTO ALBUMS.

In the third chapter of these articles I advised that prints intended for one's own collection be mounted in book form. Instructions for making albums according to the plan suggested have so often been published that I thought a few words upon the subject were sufficient. But the letters that I have received asking for details have reminded me that these papers are for beginners, not for those who have been studying photographic literature for five or ten years.

To begin with, the printing-frame must be larger than the negatives to be printed from, as large at least as the sheet of paper on which the printing is to be done, and a little larger would be better. A 4 by 5 negative may be printed in a 5 by 7 frame, but it will give a rather narrow border around the print. A  $6\frac{1}{2}$  by  $8\frac{1}{2}$  frame would be better. Whatever size of frame is used it must of course be fitted with a plain

glass, also a cardboard mat in the center of which is cut an opening large enough to loosely receive the negative. Next cut a mat of black paper as large as the printing-frame and with an opening a little smaller than the negative. A quarter of an inch all around the plate is usually enough to hide all the frills and blotches at its edges. For a 4 by 5 plate this would make the opening  $3\frac{1}{2}$  by  $4\frac{1}{2}$ . But if your negatives are matted, as recommended in the directions for printing Vinco paper, the opening may be a quarter of an inch larger each way. In that case all that is necessary is to shut out the light from between the negative and the cardboard mat.

Instead of putting the mat of black paper on the back of the negative, as recommended by the manufacturers of Vinco, I would advise that it be placed on the face. That will give a sharper line and help to protect the negative from scratches. It is true that if placed on the face it can never be removed; but you will never want to remove it.

Along the edge of the best of negatives there are always frills, scratches, and blotches, that necessitate trimming

off at least an eighth of an inch from the edge of each print, very often much more can be profitably cut away. If a strip of black paper, just as wide as the strip that would be cut from the print, is placed on the negative, it will save the trimming and nothing will be lost from the picture.

I prefer to cut the paper the exact size required before printing. There is really no necessity of using larger paper and trimming it after toning, as some writers advise. An inch of margin all around the picture, with an extra half inch at the left (or at the top if it is an upright) will be sufficient for any size not larger than  $6\frac{1}{2}$  by  $8\frac{1}{2}$ . If your negatives are smaller than 4 by 5 it will be well to put two or more on a page. They may be printed one at a time, but a better way is to cut the required number of openings in the mat and print them all at once. If you follow that plan the openings in the cardboard mat should be small enough so that the negatives will fit quite snugly. Otherwise there is danger of the negatives being moved when you open the printing-frame to examine the progress of the printing. Whenever possible negatives



of equal density should be selected for each page of the album; but if one does print faster than the others, it may be masked by simply placing a mask of black paper over it, or between it and the sensitive paper, until the others are finished. Don't crowd the prints too closely together. Even if they are "brownies" the page will look much neater when there is an inch of white paper between each print, than when there is only half that much.

If the negatives are matted, the paper mask may be placed between the plain glass and the cardboard mat; otherwise it should come between the negative and the sensitive paper.

Several have asked my opinion as to the most suitable paper to use for album leaves. Any paper is suitable; but that coated on heavy stock usually gives better satisfaction than the thin papers, as the latter often have a decided tendency to curl. An album of blue-prints made from negatives suitable for that process will never fail to attract admiration from all who see it. This simple, cheap, and consequently much despised process has great pictorial possibilities; and those who use it ought

to strive to make their blue-prints in every way *pictures*. Plain silvered paper is also excellent for this purpose. Formulas for sensitizing and directions for working this paper can be found in any photographic encyclopedia. It is a rather troublesome process, however; and it requires more attention than most amateurs have the time to give it. But for cheapness, ease of manipulation, and beauty of results, I have seen nothing to equal Vinco.

The most simple manner of binding the leaves together is to punch three or four holes in the wide margin and lace them between bristol-board, stencil-board, or leatherette covers. Or if one's taste is more fastidious, and his pocketbook will permit, the covers may be of leather, and the binding done at a regular bookbindery.

One may have a number of albums made after this plan; one for each class of pictures, for each season's work, or for each photographic tour. And if the leaves are bound by lacing it will permit the addition or rearrangement of leaves at any time.

## CHAPTER VII.

## DARK BORDERS FOR ALBUM LEAVES.

One of my friends, who is almost a novice in photographic matters, inquires for a method of matting negatives to give white and black lines around the picture. Such lines are often seen in half-tone engravings, but I have never seen them in photographs, and I doubt if the effect would be a pleasing one. Another of my beginner friends is anxious to know how to get dark borders on album leaves, with a narrow white mat between the border and picture. I once made such an album, and though it required more work and a little more care than it would by the method described in last chapter, I felt well repaid for the additional trouble.

The album in question was made from 5 by 7 negatives. The printing was done on Velox paper cut to the exact size ( $6\frac{1}{2}$  by 9) before it was printed. Each picture was  $4\frac{1}{2}$  by  $6\frac{1}{2}$ ,

so it will be seen that the mask covered a quarter of an inch of the negative all around the edges. The mask was made of black paper, and two lines drawn with white ink along one side and end, showing the exact position the paper should occupy in printing. I think that orange paper with black lines would answer the purpose just as well, but white ink can be obtained at any store where artists' materials are kept. Next I secured a piece of pen-and-ink drawing paper (I believe that bristol-board is the same thing) and cut it to fit one of my printing frames, both of which were 8 by 10. In the center of this I mounted a 5 by 7 piece of black paper; and then drew two lines with black ink to show where the printing paper should be placed to make this black mask occupy the same relative position that the negative did when printing. To make this paper translucent I rubbed it with a mixture of equal parts of paraffin and vaseline, but it would probably print quite fast enough for most people without that.

I printed by artificial light, using one frame for the negatives and another for the drawing-paper mask. First I would

print the picture. Had the paper been developed then it would have shown a white border an inch wide at both sides and one end. At the other end it would have been an inch and a half wide. But before developing I placed the paper in the other frame, guided by the black lines to secure the right position. When it was again exposed the black paper covered the part already printed and a quarter of an inch of the white border all around it, while the light coming through the translucent drawing-paper printed all the remainder of the paper.

The borders of this album were of a universal black, but if one were so disposed they might be varied in tone by increasing or diminishing the exposure. A slight underexposure will give a dark gray tone. If the time is still further reduced, the shade of gray will be lighter. Overexpose slightly, and the tone becomes greenish black; while a very great overexposure will give brown or green tones.

If only black-and-white lines are wanted it will be quite impossible to cut strips of black paper narrow enough. In that case the lines may be drawn on

the drawing-paper mat with a ruling-pen and black ink. This mat, you must remember, is a negative, so where a white line is desired on the print a black one must be made on the mat. If a narrow white line is wanted next to the print, the black paper mask on this mat must be just large enough to cover the picture and this line. That will require a good deal of care in adjusting the paper exactly to the guide lines each time, but I am satisfied that it can be done if one is careful.

Another reader wants to know how to dry unmounted prints so they will not curl. Album leaves are unmounted prints, so this is probably the place for the answer.

Bromide paper, which of course includes the "gas-light" developing papers, and gelatin print-out paper of the Solio type, may be soaked for a few minutes in a bath composed of one part glycerin to five parts water. They will then dry flat and remain flexible. This will not work with collodion paper, such as Aristo-Platino, however. If you try it you will simply get oily-faced prints that will curl as bad as ever. Some collodion papers can be dried between

blotters, but I believe other brands are inclined to stick to the blotters. It is a very simple matter to straighten the prints on any kind of paper, however. If flat prints is all that is wanted, it is not really worth while to give them a bath in the glycerin and water.

Prints that are dried on a flat surface will invariably curl up at the corners. To straighten them out lay one face down on the table, place a ruler or other flat object with a straight edge on the top of it, and while this is held down quite firmly with one hand, with the other take the print by one corner and draw it up across the edge of the ruler. This will curve one corner in the other way. Repeat the operation with the other three corners and then throw the print face up and it will immediately flatten out.

#### PINHOLES IN NEGATIVES.

Some time ago I received a negative from a correspondent who stated that he was greatly troubled with pinholes. The negative reached me in something less than a thousand pieces, but I found pinholes on most of the pieces. They

had the appearance of those caused by particles of dust on the film during exposure, but my correspondent assured me that he was very careful to dust out his holders and dust his plates. Without knowing the particulars more fully I can suggest no remedy but *more care*. I get pinholes myself sometimes, but when I see them on one negative I am more careful for a while and they do not trouble me till I get careless again or load my holders in a hurry.



## CHAPTER VIII.

## "18K. OIL PAINTING."

Several years ago a young relative of mine brought me two pictures to examine and asked me if I had ever seen anything like them before. I looked them over. One was a bust portrait of a young woman, the other the full figure of a child. The photographs were mounted between two pieces of glass, bound together in lantern-slide style and backed with opaque paper. The color of eyes, hair and drapery, with a slight tint of blue in the background, was rendered in a delicate, and for other subjects, rather pleasing manner.

I handed the pictures back to the young man, saying as I did so: "Yes, I have seen such work before. But those photographs are unusually good subjects for that style of coloring."

"When? Where did you ever see anything like that?" he demanded.

I ran my fingers through the gray

matter on the outside of my head (for my hair is no longer as black as it used to be), and the gray matter on the inside went to work hunting up the recollection I wanted. It was found presently and I answered: "The first time I saw it was when I was a boy of not more than half your age. It was during my first term at an academy, when a little wizen-faced woman came to the school and announced that for two weeks she would be in the village prepared to give lessons in this beautiful art of German oil painting. Her terms were \$5 for a course of complete instructions; but as students usually had many expenses to meet, and were often cramped for the means wherewith to meet them, she would make a special reduction to members of the school. Students and teachers alike were to be taught for the paltry sum of \$3. After she had gone the principal of the school advised students who contemplated accepting this offer to first consult Professor Blank, who had been something of a sucker himself in his younger days. He put it in more elegant language than that, but we all knew what he meant. Since then I have seen many such pic-

tures, in different places and under different circumstances."

"They were not like these," the young man protested; "this process was invented by a man who is now in town teaching it. He has a patent on it. I read the patent myself. It is all based on reflection, and —" but I have forgotten what else he said. In fact, I was not thinking about what he was saying; I was wondering what kind of a bunko man he had run up against.

I saw him soon afterward. He was smooth of tongue and suave of manner. He buttoned his vest with \$5 pieces, his coat with tens, and his overcoat he fastened with a row of double eagles. He advertised his business on the streets every evening, and to draw a crowd he would give to the small boy who would yell the loudest a new silver dollar. Then he would generously throw a handful of dimes for the disappointed ones to scramble for. Oh, he was a blooded sport! Just the sort of a chap to catch the eye and the ducats of the gullible.

He taught the art of 18K oil painting in one lesson. His charge was only \$2 — a mere bagatelle. He only charged

that to keep up expenses of traveling and advertising. He worked for the love of it, and lived on his — gall.

His pupils were taught to coat the face of a photograph with a paste made by dissolving 18K cement in water. This cement came in thin transparent sheets, and he sold about a sixteenth of an ounce of it for 15 cents. (If you buy it in a drug store they will charge you 5 cents an ounce for it.) It would not keep after being dissolved. (Of course not. Gelatin paste will never keep long without a preservative. Here is one that will keep, though:

Transparent gelatin .....	1	ounce
Water .....	4	ounces
Wood alcohol .....	1	ounce
Glycerin .....	$\frac{1}{4}$	ounce

Soak the gelatin in cold water, then dissolve by heat and add the other ingredients. It must be warmed slightly for use.)

The photograph, after being coated with this cement, was carefully pressed or rolled into contact with a piece of clean glass. While it was drying the artist took another piece of glass, placed it on the face of the first one so that the photograph could be seen

through both, and proceeded to paint in the colors with oil paint. There were two spots of blue, we will say, for the eyes; the forehead received a daub of white with enough red added to give it a flesh tint; the cheeks and lips were usually colored more in accordance with the artist's taste, or lack of it, than with the requirements of the subject. When the thing was finished it looked like a colored crayon drawing of a snow-man such as we used to make when we were little tads. This was intended to go behind the photograph, and in order that the color might be seen through the latter it was necessary to buy a bottle of 18K Transparent Solution to rub over it till it became translucent. (This solution was probably castor oil, with the addition of some cheap perfume for a blind; but any kind of oil will do.) When the paint was dry the glasses were bound together with the paint and back of the photograph in contact. The color seen through the translucent paper of the photograph is quite subdued, and with the right kind of a picture to start with, is rather pleasing. It is out of my line, however, and I never tried it myself.

## CHAPTER IX.

ENLARGING NEGATIVES AND ENLARGED  
NEGATIVES.

There are many different processes of enlarging, and it may be well to touch briefly on them all.

The most simple is to make an enlarged copy from a direct print. We used to be told that a glossy print would make the best copy, but I think that is a doubtful question. I have never tested it sufficiently to deny the claim, but I have made as good copies from mat surface collodion paper as I ever did from a glossy print. By this method, however, it is not practicable to enlarge more than about one-fourth of the original size of the print. A cabinet photograph, if a good one, can generally be enlarged to a 5 by 7 without serious difficulty.

Another method is to enlarge the negative itself. This is a method that I never tried but once, then only for an experiment; but if you want to enlarge some of your negatives it is worth try-

ing. The gelatin film is stripped from the glass or celluloid support and placed in water till it swells to the required size. It is then lifted out upon a clean glass that has previously been given a coat of gelatin and when dry it is ready to print from.

To strip the film from the glass Hammer recommends immersing the plate in water, to each ounce of which has been added a few drops of hydrofluoric acid. The formula that I used is one that was published in one of Seed's Manuals. Here it is: Soak the plate for one hour in a bath composed of one dram of sodium fluoride to the ounce of water. Then immerse without washing in:

Water .....7 ounces  
Sulphuric acid .....1 dram

When the film begins to loosen it may be rolled, but must not be pulled away from the support. The coating for the plate to be used as a final support is made as follows:

Gelatin .....1 ounce  
Water .....6 ounces  
Glycerin .....3 drams

This coating is poured on the plate while warm, and after it sets and dries

it is ready to receive the enlarged film. By this method negatives may be enlarged about one-third.

But the best way to make a large negative from a small one is by the old-fashioned method of making a transparency from the original negative, and the enlarged negative from that. This method I will describe in detail.

We will suppose that it is desired to make an 8 by 10 negative from a 4 by 5. Provide a good wide board as long as some north window at which you can work, and cut a hole in the center of it just a little smaller than the negative. On one side of this board paste a sheet of tissue paper over the hole; on the other side drive two tacks near the upper and two near the lower edge of the opening so that the negative may be slid in between them and held in position by the tack-heads. That is all the special apparatus necessary. The board is placed on the window sill, where it may be held by leaning something against it, with the tissue on the outside. Then the negative is slipped into position and the blind drawn down to the top of the board. If there are any other windows in the room the blinds



should be drawn on them also, so as to exclude from the room, as far as possible, all light that does not come through the negative. Now plant your camera squarely in front of the negative and take a photograph of it just as you would in making a copy. The result will, of course, be a positive, and it may be made on a 4 by 5 plate; or, if you prefer to use a larger plate, the enlarging can be divided between the two operations of making the positive and the negative. The latter plan entails a slight additional expense for the larger plate, but if the subject is appropriate the positive may be framed and used as a window transparency, so that it is not entirely lost. It will be useless for me to attempt to tell you how long to expose the plate. That will depend upon the light, density of the negative, stop used, and times of enlargement. I judge by the illumination of the image on the ground glass, and with the latitude that the modern dry-plates give, I have no trouble. If you are in doubt about the exposure required, and do not want to risk the loss of two or three plates trying it, just carefully note the illumination on the ground glass and

take the camera outside. Focus on any convenient object and stop down the lens till you have an illumination similar to the one the negative gave you. Then consult your exposure tables and when you find the exposure that subject, light and stop calls for, you will know how long to expose for the positive. It is best to give full time and trust to a strong developer, strongly restrained, to bring out the contrast. When the positive is finished it may be doctored or retouched if necessary, and it is ready to take the place of the negative from which it was made. The enlarged negative is made from this in precisely the same manner that it was made from the small negative.

This method of enlarging is generally quite satisfactory; but better results will be obtained by enlarging direct upon bromide paper. Bromide enlarging is by no means as difficult as some amateurs suppose. Unless a large number of prints are to be made from one negative it will be less trouble to make them direct upon bromide paper than to make an enlarged negative.

## CHAPTER X.

## ENLARGING WITH BROMIDE PAPER.

The merits of enlarging on bromide paper are quite generally recognized; yet the process is practiced by comparatively few photographers, either amateur or professional. Many professionals claim that there is not sufficient demand for this class of work to justify them for the work and expense of putting out samples and making an effort to gain the trade, but those who make enlargements seem to have no trouble about keeping busy. Just why it is not more extensively practiced by amateurs it is difficult to say.

The large majority of amateurs use cameras not larger than 4 by 5, and when they get a negative that is really good they are sure to wish that it was at least four times as large and begin to wonder when they will be able to get another camera. Well, a big camera is a fine thing to have sometimes; but you can not carry an 11 by 14, or even

a  $6\frac{1}{2}$  by  $8\frac{1}{2}$ , as readily as you can a little 4 by 5, and when you have only the big one you are apt to leave it at home sometimes when you will miss some fine pictures. If you are rich enough to afford two or three cameras, of different sizes, you will be sure to take the wrong one with you unless you are also able to afford the services of a porter to carry them all.

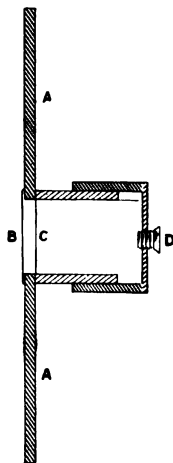
From a good, sharp 4 by 5 negative an 8 by 10, or an 11 by 14 bromide enlargement, that in every respect equals, and in some respects excels, a direct print from the same negative, can be made with a very simple apparatus that any man or woman of ordinary intelligence can improvise. Such a print softens, without destroying, the fine detail that the "Fuzzies" were so strongly condemning in the columns of THE PHOTO-BEACON not many moons ago. The expense of making it need not be a penny more than for a direct print of the same size. Some brands of enlarging paper come high, it is true, but Vinco or Velox makes as good enlargements as any of them. I have never tried any other developing paper for this purpose, but I see no reason

why any brand would not do just as well.

The making of a large print from a small negative differs in no way from the making of a large negative from a small positive. If you have a camera of sufficient size you can substitute bromide paper for the dry-plate and follow the directions given in last month's paper. My camera is a  $6\frac{1}{2}$  by  $8\frac{1}{2}$ , so when I wanted to make enlargements I first had to make a camera. It took me about two hours, and cost me nothing. I will describe it and you can go and do likewise.

My darkroom has a window opening to the north, which can be removed without difficulty. I replaced it with a wide board, in the center of which I had cut a hole  $6\frac{1}{4}$  inches high and  $8\frac{1}{4}$  inches wide. On the inside of this I nailed a box 7 inches high,  $8\frac{1}{2}$  inches wide and 8 inches long. Both ends were left open, and one of the ends was nailed over the opening in the board, with the bottom  $\frac{1}{8}$  inch below the bottom of the opening. A negative placed in this box, with the bottom edge resting on it, lost only  $\frac{1}{8}$  inch at the edges; all the rest could be seen through the opening in

the board. Above the negative there was a little space to spare; just enough room for a catch to hold the negative in position. Next I made a similar box, equal in length, and just large enough



to fit snugly over the first one, but with one end closed. In the middle of the closed end I cut an opening to receive the front-board of my camera. That is all. If my explanation has failed to make the matter plain, the drawing will

straighten it out. *a* is the board that takes the place of my window; *b* is a sheet of tissue paper that covers the opening in this board; *c* is the negative, and *d* is the lens carried on the inside of the sliding box. This box, by the way, is a camera, and is focused by sliding it back and forth.

All you will need in addition to this is an easel on which to carry the paper. The easiest way to make one is to take a dry-goods box and set it on end on a table or stand. The paper can be fastened to the bottom of the box with a tack at each corner. Mine is built on a much more elaborate plan than that. It has a large glass front, against which the surface of the paper is held by a back, like the back of a printing-frame. The image passes through the glass before it reaches the surface of the paper. This is a very convenient arrangement, but it is by no means essential to the making of good enlargements.

If you use the regular enlarging paper the directions will come with each package, so nothing need be said about methods of working. But if you use "gas-light" developing paper you may

have some trouble at first to get the correct exposure. It is a good plan to test each negative with a strip of paper before making the exposure on the large sheet. Part of the strip can be exposed for, we will say one minute, while the rest of the paper is protected from the light by a piece of cardboard held in front of it. Then by moving the cardboard another section can be exposed for an equal length of time, and so on till the entire strip has been exposed. If this strip is five inches long and one inch is exposed at each time, it will have been given five different exposures and it will be seen on developing which section has received the correct exposure.

If you use a dry-goods box for an easel it will be necessary to paste or tack a piece of white paper on it to assist in focusing, as the image can not be distinctly seen on wood. This easel is moved back and forth till the desired size of enlargement is secured, then it is brought into focus by sliding the box that carries the lens to the proper position. The whole operation is so simple that no one need fear to try it, and once tried it will often be practiced.



## CHAPTER XI.

## A SIMPLE ENLARGING CAMERA.

Using a darkroom for an enlarging camera is all right if you have a darkroom that can be provided with an outside light, but every beginner does not have such a room. There is probably a much larger number of amateurs who do their developing in a closet or some room temporarily darkened for the purpose, than there is of those who have a darkroom that could be utilized for enlarging. It follows, therefore, that if the majority of amateurs would do enlarging they must have either an enlarging lantern or an enlarging camera. The former is rather expensive, but an enlarging camera can be bought for \$10 or \$15. Failing the \$10 or \$15 to invest in that way, one that is just as good, though perhaps not quite as convenient, may be made for almost nothing.

The first thing to do is to find the size necessary with the lens you use.

If you know the focus of your lens you can consult a table giving the necessary distances of negative and paper from the lens with the different times of enlargement. Such tables are to be found in any book dealing with the subject of enlarging. If you do not know the focus of your lens, or do not have such a table to refer to, the following method may be pursued to secure the desired information: Cut a sheet of plain white paper of the size that you intend to make the enlarged picture and mark a cross in the center of it with a lead pencil. Fasten it to the wall with tacks and set up your camera at the proper distance to take a photograph of it. You can focus on the black cross in the middle of the paper. The image of the paper on the ground-glass should be just the size of the negative from which you are going to enlarge. Take plenty of time to this, for it is important. When the image is of the right size and in focus, the distance from the ground-glass to lens and from paper to lens must be measured and recorded. Let us suppose a case.

Your negatives are 4 by 5 and you want to make 8 by 10 prints from them.

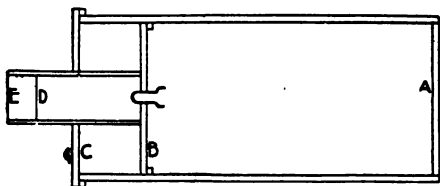
The plain paper is cut 8 by 10 inches, and the camera is adjusted till its image occupies 4 by 5 inches of the ground-glass when in focus. The distance from front-board of camera to the paper is found to be  $22\frac{1}{2}$  inches; from the front-board to the ground-glass,  $7\frac{1}{2}$  inches. Now we are ready for business.

The first thing needed is a light-tight box not less than 8 by 10 inches deep and wide, and at least two feet long. If these dimensions were exceeded a little bit it would be better. A large cracker or macaroni box will answer the purpose admirably. If it is not quite light-proof it can be made so by lining it with black paper. Remove one end of this box and in the center of it cut a hole large enough to receive the lens. If the front-board of your camera is removable this hole need not fit the lens snugly, as the front-board will cover up any light that would otherwise get through. Next make a box 9 inches long and  $4\frac{1}{8}$  by  $5\frac{1}{8}$  inches, inside measurement. This box is to receive the negative, and one end must be left open for that purpose, while over the other is nailed the board taken from the large box. Now provide a lid for

the large box, with an opening in the center in which the small one will slide back and forth. This may be made of one board, with the center cut out, or it may be made of four boards nailed together so as to leave an opening of the right size. Next nail cleats on the inside of the large box (two on opposite sides of the box are sufficient), with the upper edge just  $22\frac{1}{2}$  inches from the bottom. These cleats should not be securely nailed, as you may want to move them in making enlargements of a different size. Two shingle nails will be enough to hold each, and they need not be driven to the head, as the weight they will have to support will be insignificant. Now drive a small nail through each of the four sides of the small box so that one-fourth of an inch will project on the inside of the box just  $7\frac{1}{2}$  inches from the *outside* of the hole cut for the lens. These nails are for the negative to rest on, and they complete the camera. If any of the details have not been clearly understood the drawing will make them plain.

A is the end which was left in the box. To this the sensitive paper is attached by pushing a tack through each

corner and into the wood. B is the end which was removed from the box and nailed to the small one. This carries the lens (on its own front-board if possible). C is the cover for the large box having an opening in which the small one slides. It will be quite impossible to make this place light-tight and entirely useless to try, as any light that does come in around the small box will be intercepted by the large board that carries the lens. D is the negative, and E is a ground-glass or sheet of tissue-



paper with which the outer end of the small box is covered in making an exposure.

To use this camera it must be taken into the darkroom where the small box and the lid of the large one are removed. Then the bromide paper is fastened in position and the small box and lid replaced. Next the negative and ground-

glass are adjusted, the outer end of the small box is covered with a piece of cardboard, or anything convenient, and the camera is carried out into the light. In the early forenoon and late in the afternoon the camera may be set on end and the exposure made while it points toward the zenith. Near the middle of the day, however, a more even illumination of the negative will be secured by inclining it toward the northern sky. After the exposure the camera is again carried to the darkroom, where the paper is removed and replaced with a fresh sheet, or developed, as the case may be.

## CHAPTER XII.

## ART RATHER THAN SCIENCE.

Red spots in Aristo-Platino paper seem to trouble some of THE PHOTO-BEACON readers despite a faithful regard for the precautionary methods suggested by Mr. Hoyt in his able articles on the subject. One reader writes, "I believe the paper spots from the perverseness of its own disposition." I used to think so too; but when I took to wearing gloves whenever I printed with that paper the trouble disappeared and I concluded that it was the fault of my oily fingers. Some printers can take hold of the face of a print and have no trouble with the spots; but if I touch the back of the paper with bare fingers the spots are almost sure to appear. I have tried in a good many different ways to remove the spots, but have never found a method that was entirely satisfactory. In the toning bath a weak solution of gold will partly remove them if it is applied carefully to the spot and not

permitted to flow beyond it. In the fixing bath a saturated solution of hypo may be used in a similar manner, and the result will be about the same. After the prints are dry the spots may be partly removed by erasing them with a rubber pencil eraser. A tuft of cotton moistened with wood alcohol will entirely remove them; but you will want to look out for that stuff if you try it, or it will eat up the emulsion and leave you nothing but white paper. As a general thing a print that has red spots on it should be called a spoiled print and thrown into the waste basket without further attention.

One reader asks if it is not possible to photograph a tree in two or more sections and print them in one, similar to the printing of a panoramic view. It is possible all right, and if it were not for the necessity of using the swing-back it would be as simple as the making of an ordinary panoramic picture. I have tried it but once — the only time that I found it necessary to get the picture that I wanted.

It happened in this way: I was out in the mountains with my camera and tripod when I saw a tall fir tree growing



on the edge of a cliff. It was decidedly out of plumb — leaning outward as if to peep into the chasm that was soon to be its grave — for each year the flood was eating away a little more of the earth and rocks to which its roots valiantly clung. I wanted that tree. When I want a thing I want it bad; but there was no place around that tree that would give me a view of it without taking it in two sections. As it was I had to put my tripod in a precarious position on the very edge of the cliff. I took the lower section of the tree in the usual manner. Then I made a plumb-bob with a string and a stone and attached it to the lens so that it hung about an inch above the ground. I marked the point over which it hung and readjusted the tripod so as to take the upper section of the tree. The plumb-bob enabled me to get the lens in the same place that it had been when I made the first exposure, and the rest was easy. I had to give the swing-back a decided tilt when I made the last exposure and the negatives did not match so closely that an expert would be deceived; but they came near enough to make a picture of it.

In closing this series of articles I

want to thank those who have written for the help they have given me in their preparation by telling me what their photographic troubles were. I hope the articles have been a help to them. I feel a kindly interest in all readers of THE PHOTO-BEACON, and a double one in the beginners, for it has been to them that all of my articles have been directed. These articles have necessarily been of a practical kind, but as I still have a little space available I will use it in giving you a little theoretical talk.

Strictly speaking, photography is a science. Yet the greater part of the scientific work of photography is done in large laboratories in the preparation of plates, paper and chemicals for the photographers' use. When they reach his hands they are generally accompanied with such plain directions for their use that one need but to follow them to be successful with the necessary scientific work. A beginner who takes advantage of every available help will have very little left to guess at or learn by experiment. His elementary instruction book will tell him how to load his plateholders. By consulting his exposure tables he will know how long to

expose a plate on any subject. The developing tables recently published in THE PHOTO-BEACON by Mr. Watkins remove every element of chance in that part of the science, and with self-toning and water developing paper there is little left to learn.

Photography as practiced nowadays is either an art or a nuisance. Photographers who do not recognize and practice it as an art should be suppressed as public nuisances. Every man is not born an artist, but those who have *no* artistic ability ought to let photography alone. Of this latter class there are probably few representatives in this world of ours; for a love for the beautiful is an inborn human trait, and one who does not have it is something less than human. The most degraded of savages show this trait in one way or another, though their ideas of beauty are often very crude. They are probably no more crude, however, than the ideas of many photographers as to what constitutes a picture. The way to civilize the savage is to educate him in better ways. It is a poor rule that does not work all around; so let us all endeavor to educate the photographic savages around

us; not necessarily by telling them that their work is N. G., for that is not always safe; but by making our own work better than theirs. Let us study the principles of art and endeavor to make all our photographs conform to those principles. In this way alone will we get any real and lasting pleasure from the art of photography.

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# THE ELEMENTS OF PICTORIAL COMPOSITION.

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## CHAPTER I.

### COMPOSITION BY SPACING — STRAIGHT LINES.

For centuries it has been the custom of the people of the Occident to consider themselves highly civilized, and that those of the Orient were far behind them, in fact, were little more than barbarians. But as we have become more familiar with these people, have investigated more thoroughly the opinions and ideas of the Hindus, the Chinese and the Japanese, it has dawned upon us that they do not lag so far behind in the march of civilization, but as a matter of fact, their progress has been along a different road. No longer do we believe that they have all to learn from us, and that it is our mission to be their teachers. We now begin to realize that they have been long familiar with conceptions of both material and mental

ideas that in themselves are very good and deserving of great consideration from us, in fact, many of them being superior to those we hold.

As photographers we are most interested in their ideas of art. Not so long ago Japanese pictures were much in favor because of their quaintness and oddity. We wondered at them and smiled. It seemed to us ridiculous that any cultured people could believe that such quaint conceits possessed any artistic merit, but as we became more familiar with them and studied them the more closely, it gradually dawned upon us that they had solved for themselves and in their own way, the true principles of pictorial composition, and in the last few years our art students and painters have more and more followed the pictorial ideas of the once despised Japanese art school.

The Western ideas of composition have been based upon the theory of line—that is, the principal objects in the picture had to be grouped according to some definite geometrical form. The Eastern notion is to consider the paper or canvas as being an area which is to be divided up into a number of minor

spaces, each one pleasing in outline of itself and all to form a harmonious combination. It will thus be seen that the Japanese have evolved an abstract conception of beauty, very much as certain musicians have been able to compose songs without words. To the Japanese the minor spaces need not represent anything in the heavens above, the earth beneath, or the waters under the earth. All that they insist upon is that the space shall be beautiful in outline, and that there shall be such variety of light, dark and half-tone masses as shall give pleasure to the eyes of the observer. It is, of course, advantageous when this theory is reduced to practice that these masses shall represent natural objects, because we then have human interest combined with true pictorial principles.

I must confess that I am a very materialistic individual, and to me any quality possessed by the human race is given to it with a decidedly practical end in view, and so I consider that the sense of beauty is not given to man as an abstract quality, but with a purpose of decidedly interesting him in his environment and thus leading him to study

nature, her facts and laws, so that he can use nature's products and nature's forces for his own bodily comfort. Therefore I have no sympathy with any pictorial work unless the lines or masses of which it is composed represent natural objects, but I unquestionably believe that the Japanese have evolved the theory which will best determine their arrangement. The ideas of composition held by this interesting Eastern people have been made known to the Western world in a very valuable book entitled "Composition," written by Arthur W. Dow, and published by the Baker & Taylor Company, 5 East Sixteenth street, New York, price \$1.50, and to it I am indebted for this brief conception of Japanese art which I propose to place before my readers.

I feel I had better commence my exposition of the subject by taking a space 4 by 5 in area, because it represents the size of the plate used by the average amateur photographer, but anything I say will be equally applicable to all sizes and dimensions, whether it be 5 by 7 or as odd as 1 by 7. We have just simply to consider that an area has been given  
to break up as pleasingly to the eye

as we possibly know how. In Fig. 1 I present a space whose adjacent sides are in the proportion of 4 by 5. In Fig. 2 this has been divided into two equal

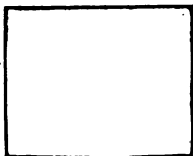


FIG. 1.

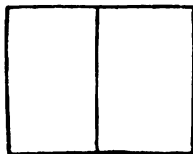


FIG. 2.

divisions by a perpendicular straight line, and in Fig. 3 by one that is horizontal. This is a very elementary idea of division because the minor spaces are uniform. As we all know, the laws of

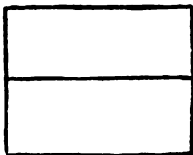


FIG. 3.

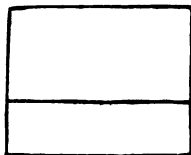


FIG. 4.

nature are absolute. Man is under law and therefore subordinate, and so whatever he evolves is not absolute, but possesses exceptions; that is to say, he

makes rules, not laws. This peculiarity runs through all his manifestations, and so in art he detests too much uniformity. He likes order, but demands variety, and so the equal division of an area is not at all satisfying to him. In Figs. 4 and 5 I have divided our original spaces in two minor ones as before, but of unequal size, and these will give more

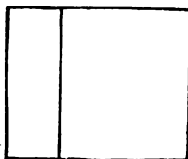


FIG. 5.

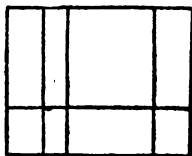


FIG. 6.

pleasure to the human eye simply because of their variety.

We can now enlarge on this idea almost indefinitely. For instance, in Fig. 6 our area by means of four straight lines has been broken up into no less than eight spaces, each of which is different from all the seven others, and the combination is very much more pleasing than that shown in the previous illustrations. Here we have the key to the mental pleasure excited by checks such

as are found in ordinary gentlemen's clothing and in tartans or plaids so much favored by the Scotch Highlander. In the latter we have the element of color combined with great variety of spacing, and the result is usually a very pleasing combination. In Fig. 7 our original space has been broken up into a dozen smaller ones, but here we find great variety combined with uniformity, as the arrangement is such that we get

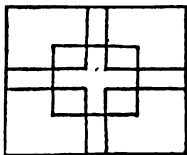


FIG. 7.

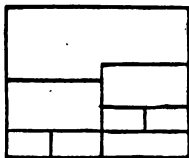


FIG. 8.

four uniform masses, each of these subdivided into smaller masses of varied shape. In Fig. 8 the idea of symmetry has been departed from entirely, and here our original area has been divided into eight great divisions, which give a combination very pleasing to the eye and yet very utilitarian, since it gives a design which can be utilized for some



such article of furniture as the interior arrangements of a bureau.

Before completing this chapter I wish to give one or two practical illustrations of how this conception of composition can be utilized in actual photographic work. Fig. 9 illustrates just such a

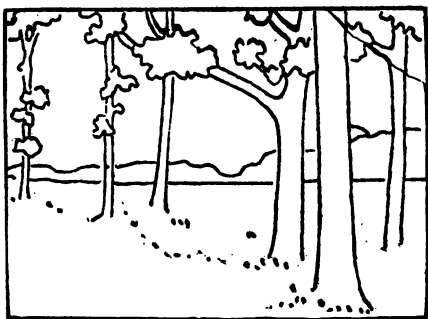


FIG. 9.

landscape as can be found almost anywhere. We have here half a dozen trees whose trunks consist of perpendicular lines. The point of view has been so selected that they fall naturally into two groups of three each, and each of these minor spaces has been subdivided into three others, each of which differs

in width from that of the other two, while the large space that separates the two groups is wider than any of the

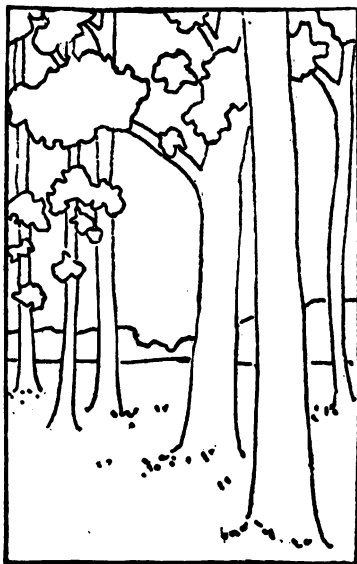


FIG. 10.

others. A little variety in the outline is secured by the oblique angle of the branches, thus breaking up our second-

ary spaces into a number of smaller ones, each of which has an outline pleasing to the eye. If we look at the horizontal divisions of the area we find that the sky line, which consists apparently of

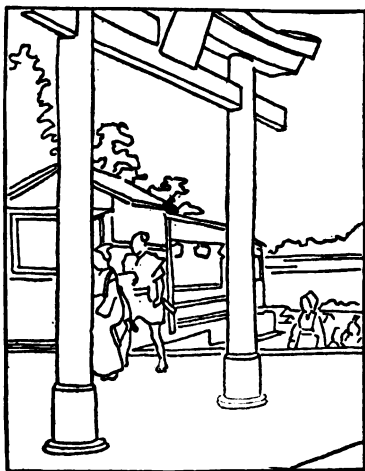


FIG. 11.

mountains, is located a little above the center of the picture, while the straight line is a little below it, and both tend to break up the spaces formed by the trunks into smaller ones. One also feels

a line running obliquely from the root of the big tree on the right past those of the other four trees, thus breaking up the foreground into two minor divisions. Fig. 10 illustrates the same group of trees arranged perpendicularly on the plate, and the remarks made regarding the previous illustration practically apply to this.

A very good example of perpendicular line composition is shown in Fig. 11, and I think I may safely leave my readers to analyze for themselves the very large number and variety of the minor spaces into which it has been subdivided.

## CHAPTER II.

## STRAIGHT LINE COMPOSITION IN PRACTICE.

Seeing is believing — that is, usually but not always. Whenever I lay down a theoretical basis for any of my notions I ordinarily find that my hearer is unwilling to go to the full logical limit of my propositions, and generally hedges by remarking that it is all very good in theory but it will not work in practice. Therefore I think it wise before going more fully into the Japanese conception of art to illustrate the practical application of the principles that have so far been set forth. It is rather hard for the average man to realize that he can produce something of pictorial merit by means of perpendicular lines with little aid from any others. To show that such is possible, I have gone through my picture drawer and selected therefrom a number of photographs that have reached me in the last few months to illustrate what pictorial possibilities

there lie before the photographer, even if he were familiar with only this narrow conception of composition.

As we are dealing with spaces alone, I have asked the artists in reproducing the photographs to give merely the outline of the masses in the prints, and not to indicate the light and shade effects.



FIG. 12.

Fig. 12 is a very simple composition, depending for its effect on the division of the area, which, by the way, is 4 by 5, into two minor spaces by the tree almost in the center of the picture. That on the right is almost devoid entirely of objects of interest, while the one on the left is broken up into nearly a dozen smaller

spaces by means of other trees. These two great divisions are again divided by means of the body of water, the distant



FIG. 13.

hills and the sky. All in all, the composition is along very simple lines, and yet the print is a very excellent rendering of winter day effect.



FIG. 14.

Fig. 13, by the same gentleman, is even simpler, for here a horizontal line divides the picture into foreground and sky, the latter by means of the trees being broken up into a number of smaller spaces. The material is the very simplest, yet the subject is charming.



A typical bit of country church in England is represented in Fig. 14, and it simply revels in perpendicular lines. The tower, with the other mass of stonework, breaks the area into three divisions — that of the building, the sky to the right of tower and that to the left, all being very different in size and dis-

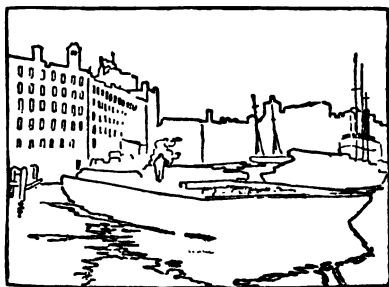


FIG. 15.

similar in outline. The large sky space is happily divided by the perpendicular lines of the trees on the left. The mass of stonework is broken up by means of the perpendicular lines of windows, doors and tombstones, with here and there a horizontal or diagonal line, into a very large number of small areas, in which we have a great amount of vari-

ety, and the result is a very pleasing combination.

Fig. 15 is the outline of a scene on the Chicago river and it will be seen that in it perpendicular lines predominate, being found in the buildings, pile-drivers, masts, chimneys and towers. The perpendicular lines of the buildings are broken by the general effect of the windows into horizontal bands, while the sky line, the margin of the river and the edges of the scow give variety of line in other directions.

Leaving outdoor subjects, I wish to draw my readers' attention to the charming child picture illustrated in Fig. 16, where the pillars of the stair and the figures of the little ones are all perpendicular. The pillars and railings to the right make subdivision of the area into two irregular-sized masses. The interest is concentrated on the principal mass by the predominance of detail there, while in the minor space there is little more than uniform shadow. The principal mass is happily broken up into minor spaces by means of the wall-paper, the figures of the children and the steps, and altogether we have a wonderfully interesting little picture.

In Fig. 17 there is a great predominance of perpendicular lines. The most



FIG. 16.

pronounced is that from the head to the lap of the lady, from there to her feet.

This line practically divides the picture spaces into two divisions. In the one on the right the legs of the table, the books,



FIG. 17.

the pictures and the pattern on the rug are all perpendicular lines, as also are the books and back of the chair, subdividing the spaces on the left. Here and

there will be found horizontal lines to offset the effect of so many perpendicular ones.

Even the veriest beginner will appre-

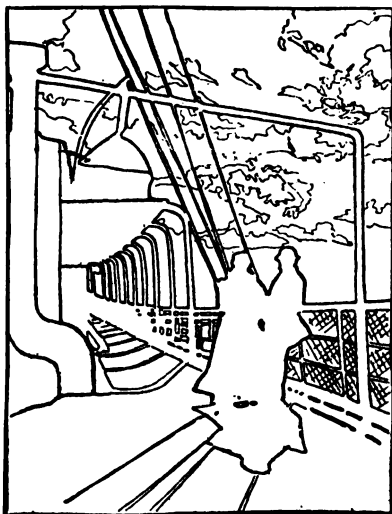


FIG. 18.

ciate the presence of perpendicular lines in Fig. 18, where the figures, the posts and the cabin walls are decidedly up-

right. This composition will repay considerable study, as there is in it great variety of spacing, both in the larger masses and in the minor details.

## CHAPTER III.

## SPACING BY CURVED LINES.

Before reading further, my readers should take their favorite prints and go over them very carefully, dividing them off into spaces according to the ideas that have been set forth in the previous chapters. It is rather difficult for the average man to fool the public for any lengthened period of time, but it is the easiest thing in the world for anybody to fool himself and to keep it up his whole life long. So, many a man thinks himself a mighty good photographer, when, as a matter of fact, he is a very ordinary individual. The great difficulty in this world is to get hold of a good measuring rod by which to measure the actual dimensions of our products.

I suppose many of my readers have come across the old barnyard fable about the chicken. Before it was hatched all the world it knew was inside the shell, and it was absolutely convinced it

knew everything, but one fine morning it got too big for its world and discarded it, and lo and behold! it discovered the world was a good deal bigger than it ever suspected. It was actually now about 20 by 30 feet, that being the dimensions of the chicken-house. In a few days it had investigated this big world and was perfectly satisfied that nothing more was to be learned, but by and by the old hen was allowed its liberty and immediately began to lead her brood around about the farm buildings. Our young friend made the important discovery that this world was a good deal bigger than it had supposed, but soon it became satisfied that it now knew all about it and nothing more was to be learned. As it grew stronger, it wandered further, and still the world kept growing bigger, with always new lessons to be learned.

So it is with our brains. Our mental horizon is the world, but every day we grow a little higher and see farther, and so our horizon line keeps extending all the time. I am in hopes that what I have written so far has resulted in raising the photographic minds of my readers to so high a plane that their hori-



zon is far beyond anything they ever had in the past and that they have realized they did not know so much about picturemaking as they really thought they did. If they have gone to their prints and dissected them in the light of the new ideas, it will be positive proof to me that I have done them some good.

It is now time to turn our attention to spacing by means of curved lines. This opens out a tremendous field for us, for there is absolutely no limit to the variety possible in lines whenever we depart from those that are straight. With the latter the only possible variation is length, thickness and direction. With the former we have all these qualities with an illimitable variety of form.

To such of my readers as are seriously taking up this kind of spacing, I would advise working on problems by the aid of flowers, their leaves, stems, and also branches of trees. They can work at the problem in two ways. Perhaps the simplest is to take a piece of plain soft boarding, into which pins can easily be thrust, and lay the flowers on that. By means of black threads they can form bounding lines of the area which is to be subdivided pictorially into

minor spaces. Then they can place the flower on the board and twist it about until they can get a combination that suits their eye, each stem, leaf and blossom being pinned into its proper position. In this exercise the purpose is the setting of the lines of the flowers in such a way that beauty shall result, and this great idea must be kept in view, that the area must be cut by the main lines. A small spray set in the middle of a big oblong or disconnected group of flowers can not be called compositions. All the lines and areas must be related one to another by connections and placings so as to form a beautiful whole.

I wish my readers to distinctly understand that they must not be slaves to the size of the plate sold by the manufacturer. So, while their camera may be a 4 by 5 or a 5 by 7, it will rarely happen that the finished print will be in anything like these proportions. I have seen many charming pictures that are square. On the other hand, I have lying on my desk a little landscape study cut from a  $6\frac{1}{2}$  by  $8\frac{1}{2}$  plate which is only 2 by  $5\frac{1}{2}$ . So, in your pictorial experiments with flowers, sometimes arbitrarily fix upon a certain area and pro-

ceed to see how well you can break it up by means of your blossoms, and on other occasions make the best possible arrangements you can with the flowers and then draw the bounding line around it. The following illustrations can not be anything but suggestive. They are printed in outline only in order to impress upon my readers how much beauty there is in line and spacing.



FIG. 19.



FIG. 20.

Fig. 19 illustrates possibilities with the despised dandelion. Here we have a rather oblong area divided by means of four parts of a flower into seven smaller spaces. In Fig. 20 a square area is just as effectively treated by another simple flower. The material used in



FIG. 21.



FIG. 22.

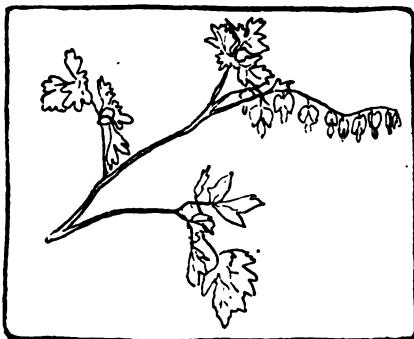


FIG. 23.

Fig. 21 can be found almost anywhere and yet it is used with great decorative effect.

Everybody admires the lilies, and Fig. 22 shows how they can be applied with great effect in decorative photography.

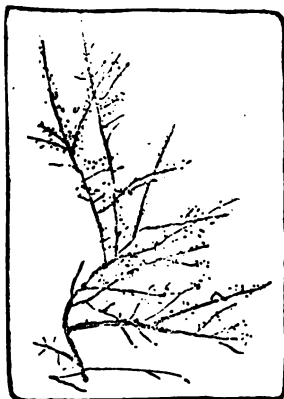


FIG. 24.

The spray shown in Fig. 23 is from a photograph by a lady correspondent whose whole photographic life is bound up in making pictures of decorative combinations of flowers. As a matter of fact, she is the only one of all my correspondents who really appreciates the

great possibilities of nature's gems in pictorial photography. She uses the very simplest materials with the most satisfactory results. Fig. 24 is an illus-

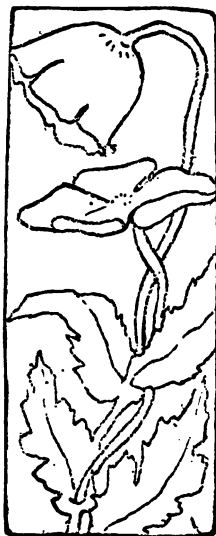


FIG. 25.

tration of this point from another of her negatives.

I conclude this chapter by an outline drawing illustrating the decorative pos-

sibilities of the poppy, and hope that I have said enough to tempt one and all of my readers to devote every spare moment for some weeks to the study of flowers from a pictorial standpoint. And I think they will acknowledge they have had a new birth by being born into the kingdom of knowledge.

## CHAPTER IV.

## SPACING OF LANDSCAPES.

For many months, sometimes years, the beginner in photography ordinarily concentrates his efforts on landscape subjects. He takes them because they interest him. Why he should do so he generally can not tell. Nature is undoubtedly beautiful in all her moods and conditions. In spring, summer, autumn or winter; in blazing sunshine or in shadow; at dawn or dusk, she is charming; but when she decks herself with green foliage and beautiful flowers, and hangs light fleecy clouds in the sky, even the dullest can see the beauty of her charms, and little wonder it is that all evince a desire to preserve the subtle beauty that interested them for even but a moment. Alas, too frequently the picture is far from being pleasing, and then the wonder arises why it should be so when the prospect was so enchanting.

This leads us to the distinction between art and nature. The purpose of

•



art is not to minutely record nature's facts. If it were so, every photographer would be pictorial. In picturemaking we utilize nature's materials for the decoration of an area, and the reason why so many photographs are failures is because the recorded facts are not decoratively arranged. When in a picture we place the trees, hills and houses in synthetic relation to each other and to the space boundary we get beauty, and if this feeling of relationship be wanting, no matter how interesting the facts may be, the photograph can not be pictorial.

Once again I have been into my picture drawer, and have culled a few prints with which to illustrate some ideas in landscape composition, and as before, giving only the outlines in order to emphasize the decorative effect of masses.

Fig. 26 is a sample of landscape that can be found almost anywhere along a river bank. The photographer is a man in whom I have taken considerable interest for a number of years, and for a long time he seemed to me a hopeless case, but suddenly he surprised me by showing me this photograph.

It is not of extraordinary excellence, but it illustrates well what can be done from very simple material. The area



FIG. 26.

here is divided into four spaces, the sky, water, trees and river bank, all varying in outline and all knit together

into a harmonious whole by part of their boundaries meeting at one point.

The same effect of convergence will be found in Fig. 27, where we find five masses, consisting of sky, trees, road and the snow banks on each side of the latter. All these minor spaces find a



FIG. 27.

common meeting point on the horizon line, and we thus feel the unity that is intended.

The picture outlines in Fig. 28 proved a warning to me never to prophecy, excepting when I knew. About three years ago the maker of it came into my office, wanting to know something about picturemaking by photography, and in response to my request handed over to me about as commonplace a lot of photo-

graphs as one could possibly conceive. When he went to the door I smiled and remarked to myself that it would be a long time until he could ever appreciate pictorial principles even to aim at picturemaking, but in less than two years he simply surprised me by the fine quality of his work. What he has accomplished can easily be done by anybody else.



FIG. 28.

The material in the illustration is of the simplest — the sky, some snow, a bush and a few trees as seen on a winter's day — yet by sheer skill in composition and lighting effect they make a

very charming picture. Horizontally, the space is divided into two by the horizon line. The sky portion is broken up by the trees on the left and the tops of the bushes, while the foreground is subdivided by the road and the clump on the right. As before, all the masses lead

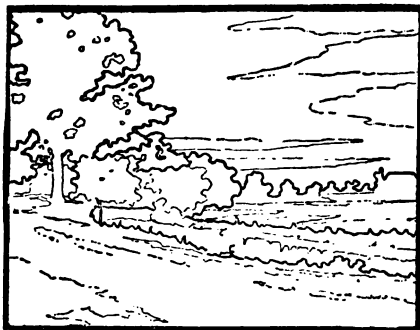


FIG. 29.

the eye to one point in the distance, where they all have a common meeting point, and so are bound together. In Fig. 29 I illustrate the massing of a composition which has more than once been awarded a prize. The scene is one that can be found almost anywhere and much of the charm of this pho-

tograph depends upon the beautiful atmospheric effect which an outline drawing can not convey.

But the lines of the composition are good. Five masses are evident — sky, trees, foreground, water and middle distance. We feel the line of the horizon cutting the picture horizontally into

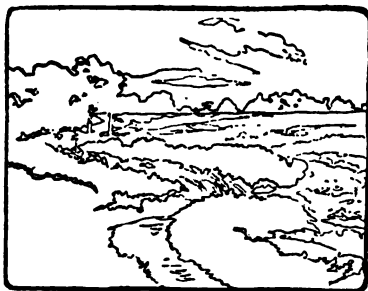


FIG. 30.

two, and another line from the trees dividing it almost perpendicularly. All the masses mentioned differ in shape from each other, and all are knit together in the clump of bushes in the distance, thus giving the necessary unity.

Practically the same idea of composition is found in Fig. 30, which is from

a negative by an artist in the East. My readers will have no difficulty, notwithstanding the difference of the subjects, in seeing how similar they are in their lines.

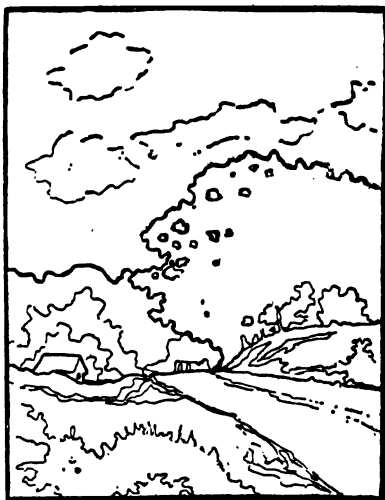


FIG. 31.

I conclude this chapter by presenting to my readers an example of combination printing by an amateur in Ohio. The composition is an excellent one, the

masses here being sky, near foliage, distant trees, road and foreground to the left — all of which meet in the middle distance. This excellent piece of composition was printed from three separate negatives, consisting of sky, middle distance, and foreground ; but the work is that of an artist and is an excellent piece of work.



## CHAPTER V.

## SPACING IN BLACK AND WHITE.

In the four preceding chapters I have endeavored to show to my readers the elementary principles of decoration by means of lines.

To me all natural objects are invariably interesting — nay, beautiful — sometimes on account of their form, sometimes because of their color, sometimes because of the wonderful adaptability to a given end. Nothing that is natural is ugly to me, and I admire the common green snake of our meadows as much as I do the golden oriole. But, much as I have seen of beauty in every natural object, I realize that every object in nature is not in itself fit for picturemaking, when rendered as it happens to be. I would define picturemaking as the decorative arrangement of the forms of natural objects in a certain area. We can consider decoration both in the abstract and in the concrete, as we can all other subjects that interest

human beings, and in the four preceding chapters I have tied myself down to the abstract conception of decoration by means of lines.

To the picturemaker the outline of an object is merely the skeleton. If we wish to represent the life and blood we must have light and shade.

To the average photographer the word shade conveys very little meaning. He works by means of light, and therefore he feels he can not have too much of it, but shade is just as essential to pictorial result as is light. Looking back over my photographic career, I can see a large number of milestones on the way. The first one I would label human interest, and at this I photographed subjects simply because I liked them. The next milestone I would entitle composition, where lines became interesting to me. So far I have considered my readers as being at this stage of advancement, and now I wish them to advance to the third milestone, which deals with lighting.

Very few people ever realize how far apart are light and dark. The most intense light that we know is the blazing glare of the sun at noonday in mid-

summer. The deepest black is the far end of a cavern at night. Between these extremes lie thousands of little stages or gradations from the one to the other. When we come to render these on paper we attempt a simply impossible task, for from the purest white of a medium to the deepest black there are not more than forty gradations. My readers can thus see that it is simply impossible to represent on paper any natural scene as it is. What, then, are we going to do?

The only thing possible is to compromise. We must give up absolutely the idea of making a faithful copy and think only of decoration. As an introduction to this I have selected a half-dozen pictures that appeared in the Chicago Photographic Salon of 1900, and I have had them reproduced in black and white to show that they possess decorative merit when even the subtlety of light and shade is lacking.

Fig. 32 is from one of the most successful pictures in the Salon. The subject was a very interesting one and was favorably commented on by everybody as an example of beautiful gradation of lighting, passing by very subtle tones from pure white to deepest black. Elim-

inating that fine tone quality, we find that it is decorative even when reproduced in black and white. The area of paper, my readers can see, contains



FIG. 32.

more shadow than light, the latter consisting of three principal masses, each of which is decidedly different in outline from all the others, and each in

turn is broken up into minor masses, each again varying in shape; hence its success as a piece of pictorial composition.

One of the daintiest things in the Salon is shown in Fig. 33. The back-



FIG. 33.



FIG. 34.

ground was practically a mass of white broken up by means of the lines of the door, which contrast in outline very decidedly with the configuration of the mass of black that represents the lady. I would draw attention to the very clever spacing of the dark where we have head, cloak and dress forming a

very large number of varied and interesting spaces. Interspersed in the masses of black we find five spots of white, all of different outline and all grouped so as to be pleasing to the eye. The larger mass is that which indicates the face and thus naturally draws the eye to the most important part of the figure.

The castle shown in Fig. 34 was another picture that pleased everybody, very largely on account of the subtlety of its gradation from black to white, but when we break it up into its very simplest elements, as it is rendered here, we find that it is very good decoratively. Three bold masses catch our eye at once, that of sky, walls and ground. Each of these is very pleasant in outline, and are each subdivided into a great variety of minor spaces, which I would advise my readers to discover for themselves, as they will find such effort exceedingly educative. I would ask them particularly to note how a minor and agreeable mass of white is interjected into the masses of black, forming a connecting link with the two large masses of white that make the sky and foreground.

One of our most successful Chicago amateurs was represented in the Salon by the picture outlines in Fig. 35. As with the others, its most attractive feature was its wonderful gradation from white to black, but even when rendered in two tones it is very pleasing. Any



FIG. 35.

one can see the four principal masses of which it is composed, how they all meet together at one point, how each is skillfully subdivided into minor spaces, and how cleverly the mass of white in the foreground is connected with that of the sky by means of the little band on the left of the picture, indicating the middle distance.

Very few of my readers would think that a salt marsh along the seashore



would provide very good material for picturemaking, yet one of the most interesting shown was of just such a sub-




FIG. 35.

ject, and Fig. 36 shows the secret of its success. Here the area of paper is broken up by means of almost parallel lines into about half a dozen main

spaces, every one of which, however, is decidedly different from the others, while each is subdivided with equal skill into many minor ones.

In Fig. 37 we have the outline of a picture entitled "Morning Mist," which was very much admired by almost every visitor to the exhibition. As a beautiful example of light and shade effect it was not surpassed by any in the Salon, but even when deprived of its most charming features, it still draws attention to itself. The horizon line breaks it into two principal divisions of black and white. But I would ask my readers to particularly note how the clump of trees breaks into the mass of white and subdivides it very cleverly into innumerable little spaces of great variety and complexity, while the water in the foreground subdivides the mass of black just as effectively.

If any of my readers happen to have prints from their best negatives on some such mat surface paper as Velox, I would advise them to invest in a small camel's-hair brush and a bottle of india ink, then to float a solid mass of the ink over all the shadows of their pictures, so as to resolve the picture, as far as



possible, into white and black, and see whether it is decorative when so treated. If it is not satisfactory to the eye after this has been done, it can have no claims to pictorial excellence.



FIG. 37.

## CHAPTER VI.

## THREE-TONE SPACING.

So far I have tried to show the elements of composition by light and shade in the very simplest manner possible by resolving some successful photographs into their bare elements of black and white, in which I endeavored to show that unless a photograph was decorative under such conditions it could not have the slightest claim to be pictorial. Following up the same idea, I now resolve some successful pictures into three tones, namely, black, white and half-tone, and will now proceed to consider them so that my readers may see further developments of this idea of picturemaking.

Fig. 38 in the original is a very successful snow scene, which was characterized by one very rare merit, that of exhibiting intense sunlight. One of the greatest difficulties that both painters and photographers have is to convey the impression of blazing sun, and suc-

cess is very, very rarely attained, but this particular picture exhibited it very decidedly, even when viewed from a



FIG. 38.

considerable distance, that is to say, the picture "carried" well. Many pictures look very nice when held in the hand,

but when placed on walls and viewed from say twenty or thirty feet they are practically lost; in other words they do not carry. All good pictures are pleasing when viewed from a considerable distance, and this one was simply ideal in that respect. Even the veriest beginner can observe that the original area in this composition is broken up into two great divisions by means of the fence and the trees. The big mass of roadway by means of half-tones is again subdivided into a very large number of minor spaces, grouped together in masses and yet presenting a most astonishing variety of form, both individually and collectively. The upper space of the picture is just as cleverly handled and the eye lingers with great pleasure over this portion, enjoying to the full the varied nature of the spacing. I would draw particular attention to how cleverly all the blacks are tied together by the connecting boughs and how a very decided black mass of pleasing form is composed of the fence, the mass of darkness in the middle and the intense blackness of the house. The whites of the picture are arranged in four big masses, two of which are in the

foreground, one in the middle distance and the other in the extreme distance ; yet they are all cleverly united by the means of little white patches, so that whether it be light or shade in which the eye is interested, it wanders pleasantly and easily from one mass to another. The half-tones indicated by the straight lines are simply stepping-stones from black to white, so that there will be no mental jar in the transition from one to the other.

In Fig. 39 the composition is of the simplest character. Anybody can see the three masses of black, half-tone and white. I would draw particular attention to the pyramidal form of the woman's figure, who, of course, is the principal object in the composition, and how this pyramid is simply a part of another which is outlined by the woman's figure and the black masses to the left of the barrel. Note particularly the masses of white interspersed through the intense black, so that the eye can not fail to go at once to the principal object on account of the contrast of the tone masses. Any one can see how pleasing the outlines are of the same white spots. I would draw partic-

ular attention to the great variety in the forms of the masses of white, whether it be the space above the woman's figure, those that are found embraced within her form, those on the barrel and



FIG. 39.

pillar to the left, or the very large one in the immediate foreground. I would also draw particular attention to the "spotting" of this composition. For instance, we can consider the whites a



being so many spots scattered over the original area, or we can view the blacks in the same way, and whichever way we take it, the arrangement is one that is very satisfactory and the eye wanders from one to another in a very simple way.

It is almost needless after what I have said about Figs. 38 and 39 to go much into detail over Fig. 40. We find here four black masses very decided in their outline, but each one is very pleasing. We have also a number of white ones just as satisfactory, and I would draw attention to the fact that the most interesting point of the picture, namely, where the tool meets the grindstone, is made emphatic by the juxtaposition of intense white and intense black, while the tool itself is simply half-tone, forming a very clever connecting link between the two kinds of masses.

The picture outlined in Fig. 41 is a very much photographed object, being the cloister of one of the missions in California, and is the most successful of this subject that I have ever seen. The masses of black and white are very regular in outline, and yet there is great variety interspersed throughout. For



FIG. 40.

instance, the arches are uniform in shape, but they differ in size, while two of them are broken by means of the distant wall into different shaped

minor spaces. Again the masses of black of the ceiling, while similar in shape, differ in length, and I would draw particular attention to the very clever way in which they are connected by the little patch of black on the wall on the left and the string of flowers on



FIG. 41.

the pillars in the middle. Altogether, this is a very satisfactory piece of composition and of light and shade.

It is very difficult to conceive of anything simpler than what is outlined in Fig. 42. The characteristic of this picture is its concentration. The mass of black is confined to one part of the pic-

ture. The half-tone is solid, while the white is composed of only two large masses; yet with all this simplicity the picture is very effective and only goes to show that a few simple objects make very good pictures when the arrange-

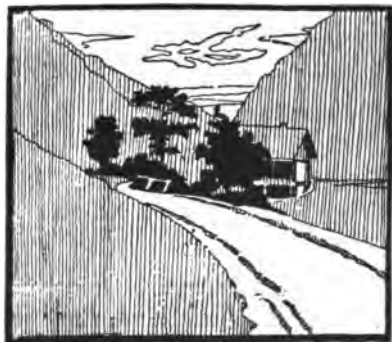


FIG. 42.

ment and the light and shade are pictorially arranged.

Even more simple is the picture illustrated in Fig. 43. It is a snow scene which could be duplicated dozens of times anywhere — a few trees, sky and foreground of snow, that is all. The sky is one tone, the foreground another.

the trees a third, and here is the secret of its success. The black trunks of the trees break up the sky very agreeably, while a few footprints judiciously placed give decoration to the foreground. I say judiciously placed, for I feel certain



FIG. 43.

that those footprints were made by the photographer with due deliberation to secure the decorative arrangement he thought most satisfactory.

I think I have said enough to implant into each of my readers some of the elementary principles whose knowledge

is essential to picturemaking. The sense of beauty is inherent in us all. Every child shows that it is possessed of it. As soon as it can walk its greatest delight is to gather flowers and chase the birds, but as we grow older this primitive sense of beauty for its own sake becomes dull within us. It must be replaced by the intellectual conception of what is beautiful, and once this idea is implanted in the human mind, then the world is viewed through different spectacles, so to speak, and every object becomes of interest either through the decorative character of its form and coloring or its utility to a given end. Unfortunately, in the case of the vast majority of human beings, this reawakening or rebirth has never occurred, and so the natural-born sense of beauty being lost, the individual wanders through life missing a vast amount of pleasure he otherwise would have.

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# **ISOCHROMATIC PHOTOGRAPHY**

**BY R. JAMES WALLACE**

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**1902.**

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# ISOCHROMATIC PHOTOGRAPHY.

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## CHAPTER I.

### LIGHT AND COLOR.

In entering upon this series of articles explanatory of the principles and practice of "orthochromatic" or "isochromatic" photography, it is my intention to start from the very beginning of the subject, assuming that the reader knows absolutely nothing beyond the ordinary practice of negativemaking — exposing and developing — and should this method appear to some to be unnecessary, I beg their indulgence for the sake of the many others who do not know, feeling that, in justice to the subject, this is the only course to pursue. My aim is to make this series a fairly complete record of experiments that will serve not only as a guide to the beginner but for reference to those who are more advanced.

#### 4 ISOCHROMATIC PHOTOGRAPHY.

Starting thus at the beginning of the subject, I shall first consider the phenomena of light and color, but only in so far as they concern the photographer, passing over everything which deals with the wave and undulatory theories as being beyond the scope of this series; and which can readily be found by the student in any book on physics and will therefore plunge at once into the analysis of light known as the spectrum.

When a beam of white light is passed through a prism it is spread out into a colored band containing six distinct colors, as follows: red, orange, yellow, green, blue and violet. Some writers claim seven colors and add "indigo" between the blue and violet, but as this color is simply a deeper and darker form of blue, showing but little difference from the color preceding it, and as the object of this article is to simplify as much as possible, we shall consider the spectrum as composed of the six colors already mentioned.

Now these six colors are not definitely separated or divided, but merge imperceptibly the one into the other, so that it is practically impossible to state where the one leaves off or the other begins.

This may be observed by passing a beam of daylight from any small opening through any kind of glass prism.

If the light be taken from a very narrow slit the spectrum is found to be very sharp and clear, and furthermore, it is seen to be characterized by the presence of a number of dark lines or bands which are known as the Fraunhofer lines (from the name of their observer) which cross the spectrum at right angles to its length (Fig. 1), and which serve as markers or milestones to instantly point out position in any spectrum under observation. It is sufficient to state that these lines are always present in the spectra of sunlight; always exactly in the same position and distance from each other. What they indicate it is not necessary to explain here.

The instrument for visually observing the spectrum is known as a spectroscope. Fig. 2 is from a photograph of one of the instruments in my laboratory with which most of my visual spectroscopic work is done. It consists of three tubes entering into a central chamber (from which the cover has been removed to show the prism). *A* is the collimeter or slit tube through which the light



# 6 ISOCHROMATIC PHOTOGRAPHY.

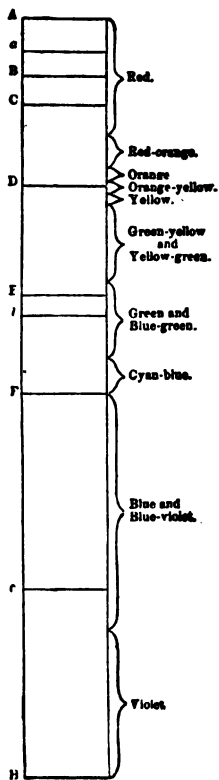


FIG. 1.



FIG. 2.

## 8 ISOCHROMATIC PHOTOGRAPHY.

passes and is focused on the prism  $P$  by a lens which is held at the inner end of the tube.  $B$  is the scale tube with its illuminating burner  $F$  and bears  $S$ , which is a very small millimeter scale divided into tenths, which is also focused upon the prism (rear surface) by a lens  $L$  in its own tube, while  $C$  is the telescope with its focusing screw  $D$  for the observation of the spectrum as it emerges from the rear surface of the prism, together with the reflected scale. There is further an additional small prism  $H$ , fixed immediately in front of, and in contact with, the outer surface of the slit plate  $K$ , the use of which will be described later.  $N$  and  $M$  are screws for moving the telescope in the observation of special portions of the spectrum.

Although, as has already been stated, the Fraunhofer lines serve to record any particular place or position on the spectrum, yet this only serves when the spectrum considered is that of daylight, for in the spectrum of artificial light the lines are absent and the appearance presented to the eye is that of one unbroken colored band, and as it would, under those circumstances, be impossible to specify or particularize any one posi-

tion, the reflected scale is used instead, and before beginning work this scale is carefully adjusted by the screws  $X$ ,  $X_2$ , so that the line marked 5.0 is exactly coincident with the  $D$  or Sodium line, that all readings may be directly comparable the one with the other.

Although this instrument is one of the very best for visual work, yet the combination of lenses in the observing telescope is altogether unsuited for work of a photographic nature, to say nothing of the cumbersomeness of the apparatus, so I use for this latter purpose a direct-vision spectroscope which is readily adapted to the camera and is shown in position in Fig. 3.  $A$  is the spectroscope and is held firmly by the solid brass base  $B$ , and entering directly in the center of the lens which projects the spectrum upon the ground glass of the camera  $C$ .

The direct vision spectroscope, Fig. 3, differs from that of angular vision, Fig. 2, by its containing a combination of five prisms of flint and crown glass alternately. By these the spectrum is projected in a straight path parallel to the length of the tube, and once a sharp focus is obtained, one may reflect a strong beam of sunlight from a heliostat

10 ISOCHROMATIC PHOTOGRAPHY.

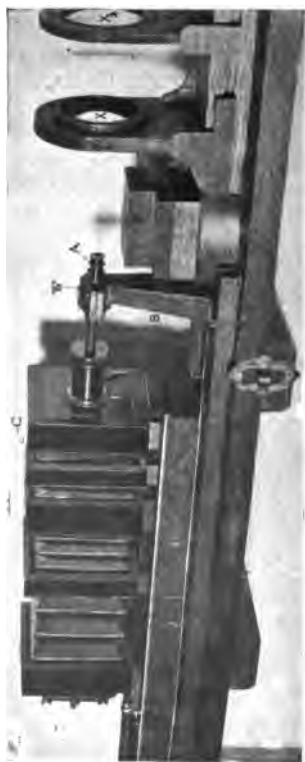


FIG. 3.

(which is focused upon the slit by the lenses  $X$  and  $X_2$ ) and make a preliminary exposure upon a sensitive plate. If the instruments be now clamped down in the same position, incandescent gas or any other source of light may be used for further experiments, the first exposure giving the record of the Fraunhofer lines to serve as "finders" for all following.

In Fig. 4 I show the arrangement used by me for incandescent gas. The two condensing lenses  $X$  and  $X_2$  with their carrying board are pivoted and swing aside out of the way, while their place is taken by the projecting lantern which has the lenses arranged for a small parallel beam of light of great intensity that falls directly upon the slit. It is with this latter instrument arranged as in Fig. 3, that all the spectra used in the illustration of this series were made; no extra care being taken to render the lines microscopically sharp but only sufficient to give the principals.

One other device which has been used is that of a brass cap which fits cleanly but loosely over the slit of the spectroscope and which is pierced with a circular opening which is again divided in

## 12 ISOCHROMATIC PHOTOGRAPHY.

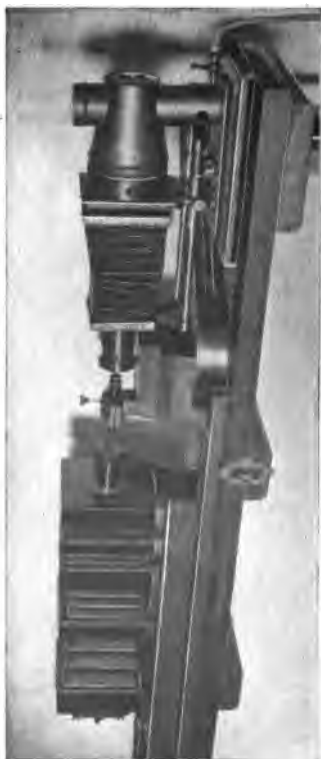


FIG. 4.

half by a tongue of metal on the inside. In use this cap is placed upon the front of the spectroscope, and the projecting tongue of metal being vertical, it cuts off or covers up just one-half of the slit — say the upper half. The plate is uncovered in the camera, the light turned on for the proper length of time and the spectrum impresses itself. The light is then shut off and the cap turned around one-half of a revolution, so that the upper half of the slit is now open while the lower half is covered. The screen or tank of dye is placed upon the platform *P* in front of the spectroscope, and the light again allowed to pass, the new spectrum impressing itself in turn immediately below the first one, with all the lines exactly coinciding and showing at a glance the sensitiveness of the plate to white light and the range of sensitiveness when screened with the particular dye that was used (Fig. 5). I have had photographs of spectra shown me by several embryo specialists which had been made by artificial light (without any lines or scale) and save only for the statement of the exhibitor — which might or might not be true — it was impossible to fix what portion it was that



#### 14 ISOCHROMATIC PHOTOGRAPHY.

had been photographed. It might have been the green, or the yellow, but then again it might have been the blue — there was no means of proving the state-



FIG. 5.

ment. With this method of two spectra on each plate there is no possibility of mistake, for in the first place the position is fixed by the presence of the lines; in the second place it is oriented against the unscreened spectrum of the plate.

## CHAPTER II.

## COLOR CONSTANTS.

The next thing which must be considered is what are known as the "color constants," and it is necessary, if the student desires to become proficient in isochromatic work, that he thoroughly understand this subject. It presents no difficulty and it opens out to him the entire field of colorwork and its bibliography.

Although we can isolate a small colored slip in the spectrum and fix its positions by means of the neighboring lines, yet that is not sufficient — we must be able to refer to it in some more definite manner, and understand something more about it.

Electricity is divided and governed by three "constants" called the volt, the ampere and the ohm, and in the same way the science of light and color is governed by its three constants called Hue, Purity and Luminosity. The hue

of a color is that which first impresses us, namely: It is red, yellow, green, blue, etc. The second constant, that of purity, means that it is a hue which is unmixed with white. A pure color does not necessarily mean a bright color, for the spectrum contains colors which are pure and yet they are of unequal degrees of brightness — the yellow for example is much brighter than the red or blue, and this brings us to the last constant, that of luminosity. This is what may be termed the "brightness" of color and means the total amount of light which it reflects to the eye, and is thus perfectly independent of the hue and the purity — for example, a small quantity of black may be mixed with some pure yellow and it may be compared against a blue. The yellow, although degraded with the presence of the black, would still be brighter than the blue, therefore, to speak correctly and scientifically, the hue would still be yellow, the purity would be lower than that of the blue, while the luminosity would be higher or greater.

It is very necessary that the student thoroughly comprehend this before going further — for these terms will be

in constant use throughout these articles, and if this point is not definitely understood, then neither will what follows. He must, therefore, study carefully this "dry" explanation and in the end he will realize that there can be nothing of more absorbing interest than this subject of "light and color."

I have now come to the point where I find it necessary to use the graphic method of explanation, one that will appeal to the eye better than will a mass of printed characters, a method which in the form of an illustration shall portray at once the special characteristics of what is being discussed, incorporating in itself its own explanation, and doing it better than any number of pages of reading matter.

Should I be desirous of showing to my readers by the aid of an illustration the effect of the solar spectrum upon normal vision, the course that would naturally suggest itself would be to give a picture of the spectrum, but as this is particularly difficult to prepare, there is fortunately another method known as the spectrum curve, which can be employed and which I shall now endeavor to explain.

## 18 ISOCHROMATIC PHOTOGRAPHY.

The luminosity or brightness of a beam of white light is, for the sake of convenience, always taken to represent 100 units. Now if this 100 unit beam be analyzed by a prism, it will, of course, be broken up into its six primary colors, and each one of these six must, therefore, represent some definite number of the primary 100 units, and Rood has calculated just what is that interrelationship between them in the following table:

Dark red.....	.33
Pure red.....	2.05
Red .....	4.57
Orange red.....	11.50
Orange and orange yellow.....	28.10
Orange yellow.....	32.76
Greenish yellow, yellow-green and green .....	12.59
Blue-green and cyan blue.....	4.57
Blue .....	2.05
Ultramarine .....	.37
Blue-violet .....	.14
Violet .....	.05

Recollect, therefore, that although the colors are practically pure, the luminosities (brightness) are vastly different, as the above table, and the most superficial observation of the spectrum shows; so, if we take a piece of paper

ruled off into squares of equal size and ten squares high, each square will stand for ten units of luminosity and the en-

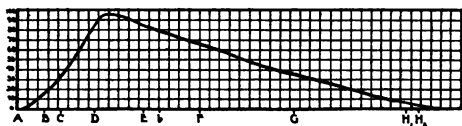


FIG. 6.

tire height for 100 (white light). Further, if the number of squares horizontally be divided off by appropriate marks (either pointed off on the base line or continued up through the entire height) and marked to represent the lettered Fraunhofer lines, then it becomes an easy matter to show any spectrum which one may be desirous of illustrating. For example: By the curve in Fig. 6, the visual appearance and correct luminosity of the solar spectrum is shown. First the horizontal lines being marked off from 0 to 100 on the side, and the Fraunhofer lines indicated, we see by reference to the table that the yellow about the region of the D line has the highest luminosity, while the blue about G is very low, etc.; there-

## 20 ISOCHROMATIC PHOTOGRAPHY.

fore, yellow, as possessing the highest luminosity, is placed at 100. This is pointed off and so on with the remaining colors, and then these points are

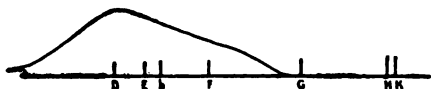


FIG. 7.

all connected by a line as shown, thus giving at a glance an illustration of the extent and luminosity of the spectrum. Again we desire to record the effect of the spectrum of white light after passing through a solution of picric acid — which absorbs the violet and blue of the spectrum. The action is graphically shown in Fig. 7, where, as may be seen, the curve dies down at about the region of the "F" line, and what in Fig. 6 was blue or violet is now represented by blackness or absence of light.

Reference now must be made to the change in the spectrum after passing the beam of white light through a colored screen or colored solution of some dye stuff. The usual observation made by any one upon looking through a sheet of red glass is to the effect that everything

has been "turned to red," but from what has already been said, the student is now in a position to know that this is not so. The white light falling upon the object has not been changed, but the red glass has simply stopped all other light than the red, generally speaking, and all the remaining five colors which go to compose the white light are absorbed by the glass, and stopped or extinguished, just as distinctly as does an extinguisher on a candle flame.



## CHAPTER III.

## HUE AND PURITY OF COLOR.

It is proper that we now enter a little more deeply into the problem of hue and purity of color.

As it is impossible with normal vision to distinguish the component colors in white light, so is it impossible for the eye to distinguish with even a rough degree of accuracy the different admixtures which go to make up a "color." We look through the red glass and we

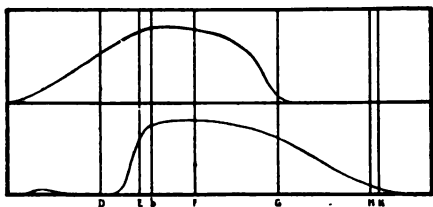


FIG. 8.

say that it passes "red" and that is all we can say; everything to which we

direct our vision is of that color and therefore we feel confident that that is the only one the glass allows to pass; but, place that same glass in front of the slit of the spectroscope and we can see that in all probability not only is the red allowed to pass freely, but also the orange and yellow, together with a little of the darker blue. In the same way we may take a yellow glass, and upon analyzing the light transmitted through it by the spectroscopes we find that, besides the yellow, it also transmits the red, the orange and the green. And

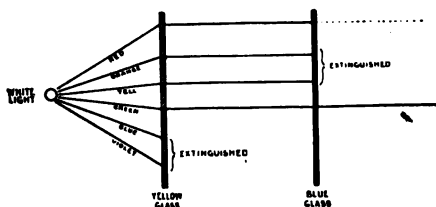


FIG. 9.

so on with any number of glasses of different colors—all will be found to transmit, *not a single color*, but a mixture.

Again, we may take a yellow glass and a blue glass, and superposing the one

## 24 ISOCHROMATIC PHOTOGRAPHY.

upon the other, we find upon looking through them that the resulting hue is green. Why is this? Let the diagram in Fig. 8 assist in the explanation. The

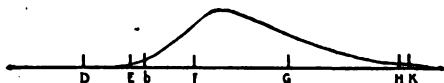


FIG. 10.

upper curve exhibits the analysis of the light transmitted by the yellow glass, which, as shown, passes the red, orange, yellow and green, while the lower curve illustrates the light transmitted by the blue glass, which also allows the *green* to pass, together with the blue (and a small portion of the red). When they are superposed the result is *green*, simply because both glasses allow that color to pass through freely, while they stop or extinguish all other colors, as Fig. 9 may possibly assist in making plainer.

In the colors of nature we are not dealing with spectral or pure hues because from the infinite variety of angles which objects present to the eye there is always present more or less white, and it is this, in a great measure, which is

the principal cause of unlikeness (otherwise than shape) in a photographic representation.

It must not be supposed that the colors of the spectrum have the power *equally* to impress themselves upon the photographic sensitive plate with their relative luminosity; in fact, it was early discovered that their power in this respect was very limited—the red, orange, yellow and yellow-green absolutely refusing to show action, while the blue-green, blue and violet were strongly active. In short, the solar spectrum, as shown by its impression on the sensitive plate, is graphically depicted by curve in Fig. 10, and again by a spectrum print in Fig. 11, which is repro-



FIG. 11.

duced from an impression on an undyed and unscreened plate, one that may be taken as representative of its class, namely, Seed 26 X. In this it will be noticed that even the blue-green with a

higher luminosity than the blue, photographs much darker. It should also be noted that all plates are sensitive in a slightly inferior degree to the invisible ultra violet rays extending to the right beyond the K line, and which are not shown in the print because sufficiently prolonged development to show this region would choke up the lines in the visible spectrum between F and H.

Now, let us compare the above "curve of sensitiveness," as it is called, with the "curve of visibility," as shown in Fig. 6. A glance is sufficient to show the great difference; for, whereas, in the visual spectrum the highest luminosity is shown to lie in the *yellow*, the greatest sensitiveness is here shown to be in the *blue* — to say nothing of the fact that the spectrum of plate sensitiveness absolutely ignores and takes no cognizance whatever of fully one-half of the colors which go to make up the spectrum. Scientifically, this plate is (generally speaking) totally insensitive to certain hues, and entirely wrong in regard to luminosity. And it is to the researches of Dr. Eder that we are indebted for the knowledge that a plate capable of representing the colors of the

spectrum with their relative luminosity should show deposit as follows: The orange at C and the blue at F should be rendered by equally dense deposits; the yellow at D by a deposit six times as dense as this, the green at E by one three times as dense, and the end of the visible violet by one ten times less dense. To render the matter still more plain, were we to expose this plate upon a subject composed of a square each of pure yellow, red and blue, where the yellow is of the highest luminosity and the blue of the lowest, with the red midway — with normal exposure — the plate would give us the exactly opposite effect, as follows: Blue, brightest, and the yellow and red equally black, and it is to remedy this that the so-called isochromatic plate was introduced.

To the beginner the use of such a plate is associated in his mind solely as a means of securing clouds with the landscape at one exposure, and the most erroneous ideas are disseminated broadcast (unconsciously perhaps) by the many large display frames sent out by the plate manufacturers, and hung in conspicuous positions by the dealer.

Isochromatism (or orthochromatism)

is a name derived from two Greek words which signify *correct color*, so that an orthochromatic plate means a "correct color" plate. Although custom has rendered its use general, yet the name has not been wisely chosen, for the plate does not reproduce objects in their correct color (nor is it intended to), but is supposed to represent colors in their relative luminosity. There is no plate yet manufactured, either in Europe or America, which is more than an approximation to the desired result.

## CHAPTER IV.

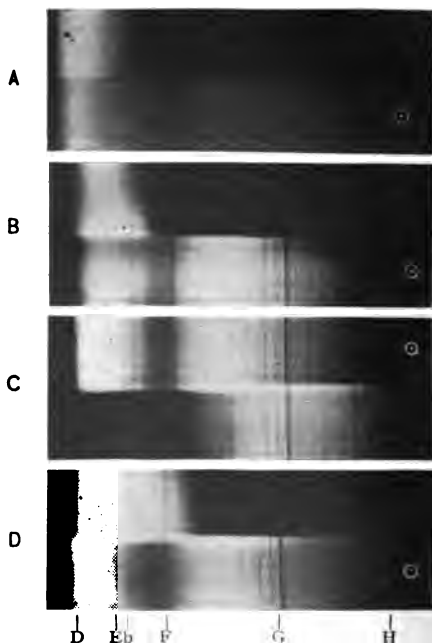
## ISOCHROMATISM.

It was early discovered (Vogel, 1873) that by introducing a small quantity of dye into the emulsion (either in the process of manufacture or by later bathing), the plate so stained exercised a selective action to certain rays of the spectrum to which it had been previously insensitive. Thus, a plate which had incorporated in its substance a small quantity of eosin was found to possess a sensitiveness to the yellow-green of the spectrum in addition to the sensitiveness which, as an emulsion, it already possessed to the blue and violet. Again, the addition of a minute quantity of quinolin blue confers a special sensitiveness to the yellow orange, and part of the red, besides the original sensitiveness to blue and violet.

Many are the dyes that have been tested and used for this purpose, but sufficient for the purpose of explanation are the two which have been mentioned.

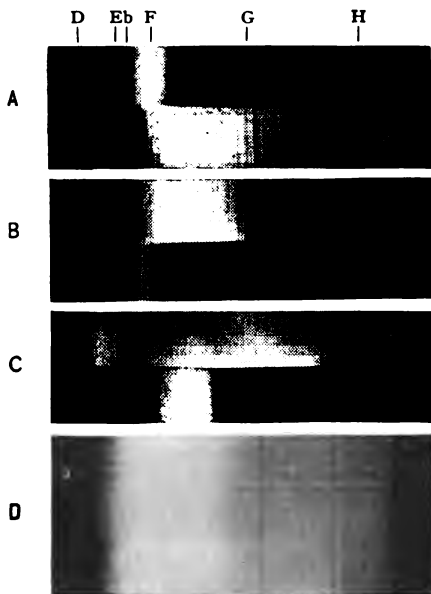


# 30 ISOCHROMATIC PHOTOGRAPHY.



A—Brilliant yellow. Cramer slow iso.  
 B—Brilliant yellow. Cramer medium iso.  
 C—Cramer medium iso. Anilin blue and Fluorescein.  
 D—Ammonium picrate. Cramer medium iso.

FIG. 12.



A—Acridin yellow. Seed 26 X.  
 B—Seed 26 X. Brilliant yellow.  
 C—Seed L. Ortho. Methylene blue and chrysoidin.  
 D—Cramer crown. Solar.

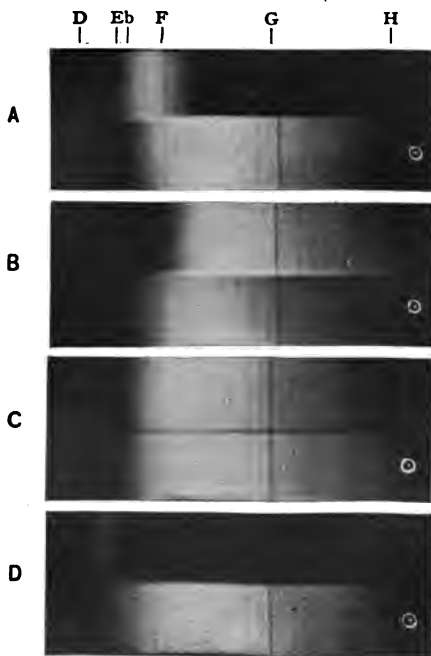
FIG. 13.

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above, for it is not necessary to enter into the details of manufacture, such plates being now a regular article of sale, and found on the shelves of almost every supply house. The isochromatizing of plates by the individual is a matter not to be considered, save only by the experimentalist who is desirous of obtaining a special action on a definite portion of the spectrum.

The dye stuffs which are used for this purpose are very unstable in their composition, the action of a beam of light being sufficient to bleach them somewhat, so that when the light which passes the lens falls upon the extremely minute amount present in the plate film, the molecular arrangement of the dye is disturbed, and that disturbance is communicated to the plate when under the action of a developer.

There is a law which governs this action, which runs as follows: *A plate is acted upon by the color which it absorbs*; for instance, eosin (a red dye) absorbs green, therefore the plate is rendered sensitive to green because that is the color which the dyed film absorbs. Quinolin blue (a blue-violet dye) absorbs yellow, orange and part of the



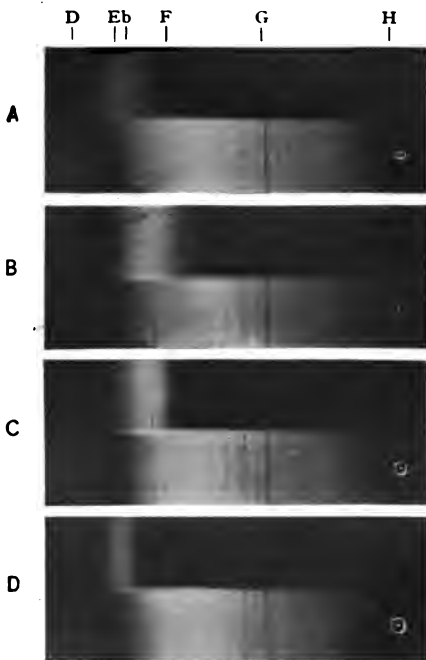
A—Methyl green and picric acid. Seed 26 X.  
 B—Gentian violet. Seed 26 X.  
 C—Cyanin. Seed 26 X.  
 D—Fluorescein (note action of violet). Seed 26 X.

FIG. 14.

red and green, therefore the film is sensitive to these hues. In other words, the green which would pass on through the film is held back (absorbed) by the dye, and under the influence of that absorption is compelled to perform certain work in the film, the nature of which is at present but little understood.

Now, so far, the problem seems to be a very simple one indeed, but there are many difficulties yet to be overcome before color can be rendered with even the roughest approximation to correct luminosity, for, although the plate has undoubtedly been rendered sensitive to, say, green, yet its sensitiveness to the blue, violet, and ultra-violet are still unimpaired, and these hues must be reduced, dimmed down or cut off, in order that the slower sensitiveness of the other colors may get an opportunity to catch up, as it were, with those of greater rapidity. This is the sole purpose of the screen or ray filter, and the correct understanding of which is the key to intelligent use.

In the lower half of the first double spectrum of Fig. 12 is shown the sensitiveness of a plate stained with one of the Fluorescein derivatives, namely, Cramer Slow Iso. It will be seen that,

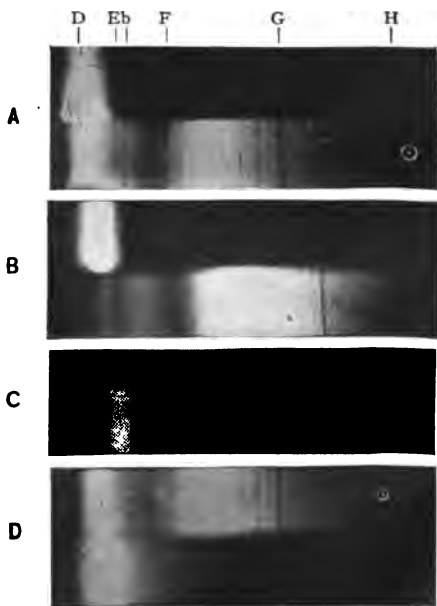


A—Chrysoidin. Solar spectrum Seed 26 X.  
 B—Iodgrun and picric acid. Seed 26 X.  
 C—Picric acid (saturated). Seed 26 X.  
 D—Auramin. Seed 26 X.

FIG. 15.

although there is a sensitiveness to the orange red of the spectrum, yet that sensitiveness is very low compared with that to the blue and violet. This print is made very light purposely in order that this point may be apparent, for were it printed up to average strength then that orange sensitiveness would not show at all. Now you can readily see that if we desire to show color in its correct luminosity we must first cut off entirely the ultra-violet rays (which are invisible to the eye) and dim down the violet and blue so that they may be held back long enough to give the green, yellow and orange a chance to impress themselves upon the plate with equal strength, and this is accomplished by the use of a yellow screen, for, as we have previously seen, yellow cuts off or dims down these colors, according to the strength of the color.

Thus we learn why an isochromatic plate and yellow screen render it possible to secure whatever cloud effect may be in the view photographed — simply that the blue of the sky is dimmed or slowed, while the white of the cloud (of higher luminosity) passes through unabsorbed.

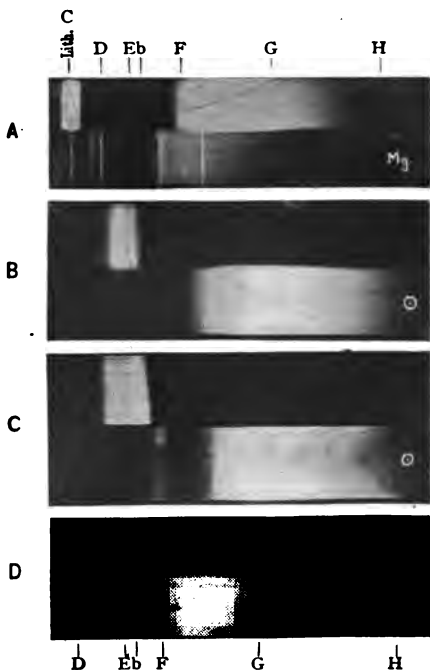


A—Carotin. Cramer Med. iso.  
 B—Eosin bluish and picric acid. "Erythro" solar.  
 C—Nile blue and Auramin. Cramer inst. iso.  
 D—Cramer inst. iso. Light green F. S.

FIG. 16.



It is most erroneously supposed by the general mass of photographers that any ray filter or yellow screen is suitable for use with any iso. or ortho. plate, but this is not so. Take the illustration shown in the last double spectrum of Fig. 12, which is representative of this class of plate, namely, Cramer instantaneous isochromatic, and it will be seen that although the use of a yellow screen is beneficial, yet it is only partly so. True, we can, by its means, cut off the blue-violet and ultra-violet, but the work is only half done; the plate is still sensitive to the yellow-green and blue to an abnormal degree compared with the blue-green, yellow and orange, and sufficient action will take place upon the plate to give a fully exposed negative by the action of those rays alone, long before that blue-green (of which the greater part of a landscape is composed) begins to impress itself. The remedy is very obvious, for if we introduce a colored filter to dim down the too strong action of the blue-violet then we must introduce another to dim down the yellow green. In other words, *a ray filter must be adjusted to the plate with which it is intended to be used*, so that a filter



A—Ethyl violet. Seed 26 X (cyanin stained).  
 B—Fast scarlet and picric acid. "Erythro."  
 C—Eosin and naphthol yellow. Lumiere panchromatic.  
 D—Aurantia. Seed 26 X.

FIG. 17.

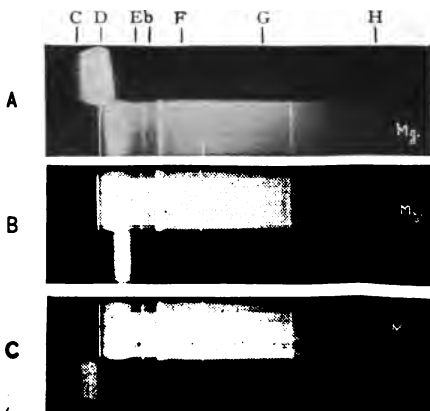
adjusted for the plate now under consideration should not be yellow only, but a mixture of yellow and crimson in proper proportion, as it is the crimson which acts upon the yellow-green. Some isochromatic plates have their strongest action in the yellow, and for such a plate a perfectly adjusted filter would be a mixture of yellow and blue, the latter dimming down the yellow. Of course such a screening down of the colors means a lengthened exposure, but this is amply made up for in superior effects, the resultant tones being more in harmony with one another.

It may be interesting to note that the firm of Cadett & Neall, of England, now manufacture a light filter and "safe light" specially adjusted to their plate. In fact, they manufacture two light filters, which they name, respectively, the "Gilvus" and the "Absolutus," and give specific instructions for their use, plainly saying that the former (the Gilvus) is merely a makeshift, as it were, to be used when the object is speed, but also stating that for correct work there can be no change from the "Absolutus." Carbutt, in this country, has a specially designed "safe light" for his polychro-

# ISOCHROMATIC PHOTOGRAPHY. 41

matic plate, also adjusted ray filters for use with it.

In spectrum work there is still another plan for obtaining stationary lines or



A—Chinolin red and picric acid. Carbutt ortho.  
 B—Seed L. ortho. Naphthol green.  
 C—Seed L. ortho. Naphthol green and erythrosin.

FIG. 18.

markers than by the use of the solar spectrum. Each metal has its own particular spectrum, which is distinguishable from another by the number and position of its lines. So when a metal is

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burned before the slit of the spectro-scope, those lines which compose its spectrum stand out as luminous bands. It is sufficient to state that these luminous lines are just as immovable as are the dark Fraunhofer lines in the sun spectra — in fact, the two are identical, only they are observed under different conditions.

The power to obtain bright lines at any time is very useful, for, as in the case of Fig. 18, they are shown by the simple method of burning a few inches of magnesium ribbon in front of the slit. In this case the magnesium had been previously moistened with dilute hydrochloric acid, and dipped in lithium chloride, thus giving in addition the splendid lithium line between B and C.

The number of dye stuffs which can be used for special purposes are very many, and from hundreds I select a few in Figs. 13 to 18, which will serve to show their values and screening action when used as filters for special purposes. In all cases, as may be seen, the unscreened spectrum of plate sensitiveness is indicated by the solar sign — a circle with a dot in the center.

## CHAPTER V.

A SPECTROSCOPICALLY CORRECT COLOR  
SENSITOMETER.

In this chapter I shall discuss the particular advantages of a specially designed color sensitometer (or plate tester), which has been perfected by the writer for the benefit of those workers in photography who may not be inclined to invest a considerable amount of money in providing themselves not only with the necessary instruments, but with the knowledge to use the same. One writer tersely says, "Mortgage your home and buy a spectroscope," but to some this method presents certain disadvantages which may, in their minds, be not quite equaled by the possession of the instrument.

Abney (an eminent authority on all photographic research work) first introduced the idea of such a sensitometer, but he did not carry the detail of the idea to the point of perfection whi

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would make it replace the spectroscope to all but the physicist, and after much experimental work the writer has succeeded in being able to place in the hands of the photographer an improved form of sensitometer which, if used with the average amount of intelligence, will perform the necessary work and give clear and definite results.

It consists essentially of a series of eight colored transparent squares, together with a "white," which are adjusted to transmit the following:

No.	Hue.	Fraunhofer lines.	Scale.
1	Dark red.....	Passes color only from A to B.....	1.5 to 2.9
2	Red.....	" " " A " C.....	1.5 " 3.5
3	Light red.....	" " " A " D minus....	1.5 " 4.8
4	Orange.....	" " " A " D plus.....	1.5 " 5.3
5	Yellow-green..	" " " D & E to b.....	5.3 " 7.5
6	Blue-green.....	" " " E to F.....	7.0 " 9.0
7	Blue.....	" " " F " G.....	9.0 " 12.7
8	White.....	All colors in white light. ....	.....
9	A rectangular slip of blue-violet which passes color from F to H, plus, 9.0 to 16.1, and which also passes a band of red from A to almost the C line, 1.5 to 3.3.		



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In addition there is a series of twenty smaller squares of neutral gray which divide a beam of light from its highest luminosity (100) to opacity (0) in equal units, that is to say, luminosity is placed for convenience at 20 instead of 100, and each successive square is

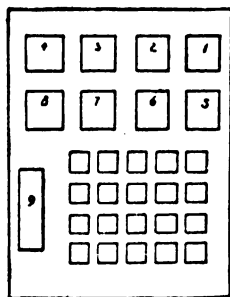


FIG. 19.

just one unit deeper than the first transparent square, so that square No. 1 passes the *full amount* of light, while square No. 20 passes none with normal exposure (see Fig. 19). In Fig. 20 is shown a representation of the solar spectrum, with both Fraunhofer lines and Bunsen scale, and divided perpendicularly throughout its length by heavy

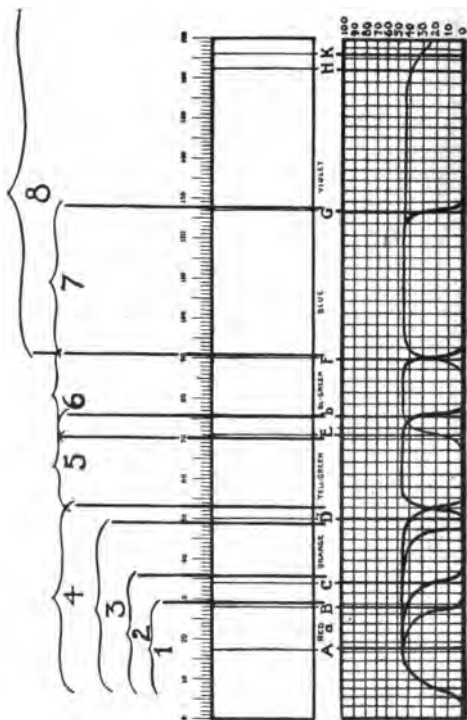


FIG. 20.

## 48 ISOCHROMATIC PHOTOGRAPHY.

black lines which indicate the amount of the spectrum which each glass passes. With such a key before the eye there can be no possible error in the reading of the deposit, either in line, scale number or Fraunhofer lines.

In use the instrument is handled in the following manner: Suppose that it is desired first to find the color sensitiveness of a particular plate — for example, the Cramer Instantaneous Isochromatic. A small size is taken ( $3\frac{1}{4}$  by  $4\frac{1}{4}$ ) and placed against the sensitometer in the darkroom in the same manner as in making a lantern slide, by contact, and exposed to light for a few seconds and then developed. It stands to reason that certain of the color squares, together with certain of the density squares, will show upon the plate, while certain others will be absent. Suppose that, after exposing and developing a plate, we find a deposit upon squares 5, 6, 7, 8 and 9; we immediately know that the plate is sensitive to yellow-green, blue-green, blue and blue-violet — the action which has taken place under square 8 being simply due to these colors, which, of course, exist in white light. If, however, the action was

shown only by a deposit on squares 2, 3, 4 and 8 then the plate would be sensitive only to the yellow, orange and part of



Seed 26 X.

FIG. 21.

1 min.

the red, the action in square 8 again being due to the presence of these colors in white light. But it is not sufficient that the color squares shall only show a

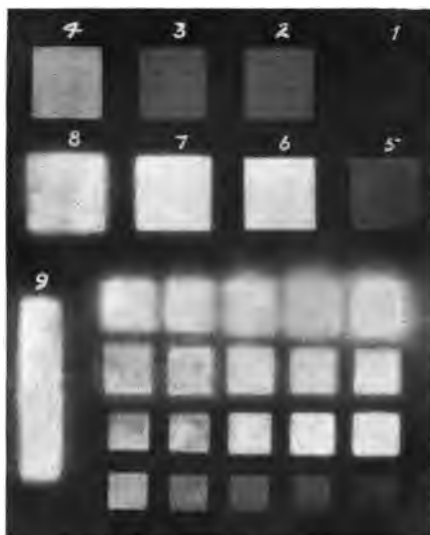
deposit — that deposit must be correct. What about the luminosity? We may say that a plate is sensitive to pure yellow, orange or red, but in what proportion is it thus sensitive — is it more strongly sensitive to the yellow than the red or vice versa? Stronger sensitiveness is shown by a stronger deposit on a negative and on square No. 4 the deposit may be twice as deep as on the other two, therefore, at first thought, it might be supposed that this was conclusive, but it is not so; the *luminosity* of the color must be taken into account.

Now, as we know, yellow has a luminosity very much higher than orange or red; suppose we take the luminosity of this yellow as represented by ten units, while that of the red we may place at one, there being nine units difference between them; therefore, in judging the depth of deposits on these two squares we should have to make allowance for that variation before we would be able to make our deductions, entailing a vast amount of work before one could arrive at any reliable result, to say nothing of the photometrical apparatus necessary to make this deduction.

Happily there is an easier and better

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way of arranging all this on the instrument itself. The seven colors have been measured by means of a photometer,



Seed 26 X.

FIG. 22.

60 min.

and the darkest color of the seven selected as unit—in this case the blue. The other six are very much brighter—

(or more luminous) than it, so one after another is compared with the blue, and their brightness (or luminosity) toned down, with a necessary amount of lamp-black in gelatin, until they are in perfect agreement with the unit blue. The red square, No. 1, requires the least amount of lampblack, while the yellow-red, No. 4, requires the most. Finally the white square is taken (No. 8) and gray is added, until it, too, corresponds to the luminosity of the others. Of course this gives but the merest outline of the work necessary to reduce these nine squares to equality of brightness, and when finished each will appear dull and dingy in hue (simply because their luminosity is so low), but should they be placed in the path of a beam of very intense white light then they show in their purity. In ordinary light the square No. 8 (white) will look particularly dull, showing a very dark gray, but if the adjustment has been perfectly and conscientiously carried out there will be no error. The essential point is that each square must transmit nothing but the single band of color it is intended to pass — the green and blue must pass no red, nor the red any blue, nor must the colors overlap

greatly. Spectroscopic adjustment is an *absolute necessity*.

Now, having all color squares reduced



Ilford process plate.

4 min.

FIG. 23.

to equal luminosity, it is a simple thing to make a comparatively exhaustive test in a few minutes. Given a plate sensitive to all rays of the spectrum (were it

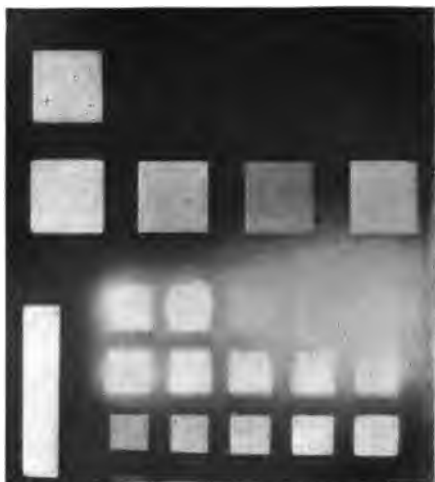


possible) it should, upon development, show a deposit on every color square. Greater sensitiveness to any particular region will be indicated by stronger deposit upon the particular square corresponding to that region.

If it be desired to test any particular screen or ray filter all that is necessary is to first pass the light through the screen or filter before it strikes the sensitometer, and if the result is not satisfactory when the plate is developed it shows just what is wrong, and how to remedy this trouble. A perfect adjustment between screen and plate (*for pure color*) will be shown by an equality of deposit on each of the nine squares. If No. 7 (blue), for example, is not represented on the negative then your screen cuts off too much of the blue and should be lightened, while if it shows too great a deposit upon the yellow then blue must be added to the screen. In short, whenever a color shows too strongly it indicates the necessity for the addition of a dye complementary to the color out of adjustment, while if a square show a weak deposit or none at all it shows that a reduction is needed of the color complementary to the square in question.

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It will be noted that I have stated that this is correct for pure color, but it does not follow that a filter perfectly ad-



Cramer slow iso.

FIG. 24.

3½ min.

justed to this end will be correct for ordinary work, that is, landscape or general photography. On the contrary it would be decidedly wrong, for it must

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be remembered that the colors in nature are not monochromatic or pure, but mixtures, together with a certain amount of



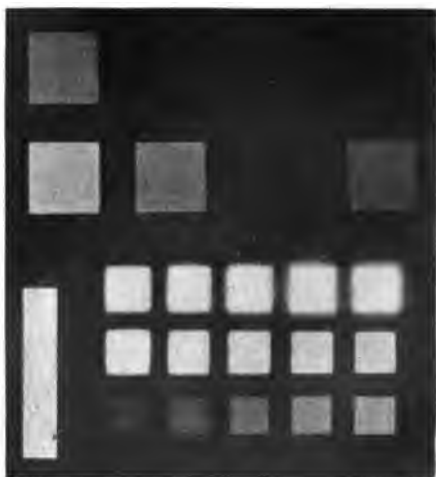
Hammer isochromatic.

1 min.

FIG. 25.

white light, allowance for which must be made in the filter. Thus a screen which would be correct for reflected "natural" color would cut off the blue

square entirely in the sensitometer print, depending for the amount of deposit on the presence of that reflected white light just alluded to.



Cramer inst. iso.

FIG. 26.

45 sec.

The instrument places in the hands of the tyro what is equal to an advanced education in photospectroscopy minus the time, apparatus and expense. It

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would be folly for the non-scientific worker to attempt the manufacture of such an instrument, for an error in the



Standard ortho.

FIG. 27.

1 min.

color transmission of any of the squares would, of course, vitiate the value of the sensitometer.

In making tests of various plates it is

absolutely necessary that they get the same amount of *light action*, not of exposure, for exposure and light action



Seed L. ortho.

FIG. 28.

1 min.

are not synonymous terms. We may expose a Cramer Slow Iso for two minutes on a certain subject and then with exactly similar conditions expose an

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Instantaneous Iso or a Seed 27 for the same time and get entirely different results. The correct time for one would be wrong for the other. So that what



Lovell C. D.

FIG. 29

45 sec.

is wanted is *equality of light action*. If we give sixty seconds exposure to Cramer Slow Iso through the sensitometer and develop, we find, besides the color

## ISOCHROMATIC PHOTOGRAPHY. 61

patch deposits, certain others under the density (or exposure) squares (1 to 20) say, up to No. 12; then what is



Carbutt polychromatic.

1 min. 30 sec.

FIG. 30.

required is that when we make a test of the Cramer Instantaneous Iso, Seed Ortho, or any other plate, we shall so expose that upon development under the



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same conditions as at first we get deposit upon No. 12, thereby showing that the



Cadett spectrum.

45 sec.

FIG. 31.

same amount of light action has occurred upon the plate.

The writer is aware that this method of obtaining a light equality record is not scientifically correct. There is only

one method which is absolute, namely, by the use of a spectrographic instrument, for it is a fact that a certain make of plate will differ from another in its speed values simply because of a difference in color sensitiveness. However, for all practical purposes, the test as given by the sensitometer is sufficient.

A word more about these latter squares. They also show the action or adaptability of a developer (or plate) to differentiation of each unit of shade, as represented by the varying thicknesses of deposit, which conditions are best conducive to clearness and which to halation. (See illustrations, Figs. 21 to 31.)

To the ordinary worker they serve to register the action of any particular anti-halation backing under extremes of light and shade, while to the color worker, or more advanced student, the color patches also stand as indicators of the value of that backing in its adaptability to colorwork, while to all the absence of deposit under any particular color square with the maximum of exposure\* indicates the light transmitted

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\* Maximum of normal exposure is hereby meant.

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by that patch as being a "safe-light" for development of the plate under test.

Compare any of the illustrations throughout this chapter with the actual spectrum photographs which have preceded them, and observe the extent of the absorption, while all the troublesome and vexing luminosity questions are forever laid at rest.



Cadett spectrum plate and Cadett "Absolutus" filter with twenty times normal exposure.

## CHAPTER VI.

## LIGHT FILTERS.

We are now brought to the question of what screen to use and when to use it, and the problem is simplicity itself. It is necessary that a filter be used on every exposure made if correct action be desired. A certain amount of discrimination may be exercised in *ordinary work*, but it must be remembered that every departure from the perfectly adjusted filter means more or less of error in reproduction of color values. As I have before shown, it is not every or any yellow screen which will serve equally well for first-class results, but one must be adjusted carefully to the plate used.

To begin with, choose the plate which when unscreened shows the best orthochromatic effect, for it is impossible to make any isochromatic work without a thorough knowledge of the plate used, or, in other words, choose that plate

which shows greater sensitiveness to the various spectrum rays than another and make your screen (or filter) to suit that plate. Of course this adjustment must not be guessed at, and to the worker who is not the possessor of the necessary apparatus, no very close approximate can be secured, but by a careful study of the spectrum or spectro-sensitometer prints which have illustrated this series, a fairly good idea may be formed. It is to be regretted that the method of reproduction necessary in order to show these illustrations does not give full justice to the negatives. A great amount of the more delicate detail, particularly in the case of the spectrum prints, is in this way lost. For example, in all of the unscreened spectrum negatives the H and K lines at the extreme limit of the visible violet are very apparent, as are also many lines beyond, but they are impossible to show here.

Now, then, having chosen your plate you will very readily see that none of the so-called "ray filters" are exactly suitable, and as the manufacture is a very simple matter there is no reason why a palpably imperfect piece of appa-

ratus be used when one can make for himself something that is better.

In the first place, it must be taken into consideration that different effects (in ordinary work) require different treatment, just as much as different strengths of light require different lengths of exposure, for the colors in nature are not pure colors, but are mixed with a considerable quantity of white light. It certainly stands to reason that with a plate sensitive to certain colors the photographing of a bright midday landscape, with its blue sky and fleecy clouds, forms an altogether different kind of problem to that of an evening sky, with its gold and crimson and its reflected yellow glory over all the view. In the former there is the minimum amount of yellow with the maximum amount of the blue, violet and ultra-violet, while in the latter there is the maximum amount of yellow and the minimum of blue and violet, while the ultra-violet is considerably suppressed by the presence of the yellow reflected "haze." For one (unless we possess an adjusted filter) we must use a screen which will act strongly upon the blues and violets and weakly in the

yellows, while in the other it should be exactly the reverse. It is right here where careful adjustment is most necessary or the effect is overdone and the picture just as badly spoiled by the one result as by the other. Every one has seen the reproductions which are scattered broadcast throughout the photographic and other magazines, and the catalogues and pamphlets of the dealer, illustrating the advantageous (?) results which may be obtained by using So-and-so's ray filter, wherein the clouds are shown as so many balls of snow or chalk suspended in a pitchy sky in a manner that makes a person think the result would surely be fatal were they to fall on them. This is one of the results of overcorrection of filter to plate. The blue has been reduced too much, therefore the sky-blue could not impress itself sufficiently fast, the result being as has just been described.

Of course it must be understood that the use of a screen or ray filter upon any plate means a lengthening of the time of exposure. There is, however, an exception; for instance, a short time ago an amateur friend was explaining to the writer the particular advantages

of the screen used by him, and which required no lengthening of the time of exposure. Upon inquiry it was learned that the screen in use was composed of a dyed film of Hofmann violet, which gave "most artistic effects" in the resulting negative. The user had never made any serious test between a view taken with and without that particular screen, but was very positive as to the improvement.

Now the fact of the matter is that there was actually no difference in the negative made through this screen than that made with an ordinary plate, as the action of the violet was to cut out by absorption the very colors to which the plate (Cramer Iso) had been specially sensitized, namely, yellow and yellow-green, and by the transmission of the blue-violet and ultra-violet had simply, as before stated, brought the plate back to the condition of an undyed film. The user had, of course, made tests; of course he had made a negative through his filter (on an iso plate), and he had also made one of the same subject without his screen (also using the iso plate), and when the writer ventured to suggest that he try one on an "ordinary"



plate he was silenced by being told that the plates were those which he always used, and it would be foolish to test on anything else. About one month later he woke up.

Here is the problem: Given a plate sensitive unequally to the various rays of the spectrum, so make your filter that it will hold back the colors which impress themselves too quickly, not cutting them off altogether, but dimming them down, and allow those that are photographically weak to pass through unhindered.

A glance through the many spectra and sensitometer prints already shown will readily solve that problem, for there are given dyes that cut off any particular ray desired, and by their judicious admixture in varying quantity any result may be secured.

For convenience (and the benefit of the beginner) I tabulate briefly a few of the principal dyes and their effect as filters upon the different hues of the spectrum.

old t  
alwa  
test  
1 le  
  
pa  
ars.  
ha  
pre  
be  
me  
hic  
d.  
tra  
wa  
re  
u-  
is  
r  
f  
r

Dye.	Absorption.
Picric acid .....	Part of the blue-violet and ultra-violet.
Naphthol yellow .....	Part of the blue-violet and ultra-violet.
Aurantia .....	Part of the blue-violet and ultra-violet.
Auramin .....	Part of the blue-violet and ultra-violet.
Metanil yellow .....	Part of the blue-violet and ultra-violet.
Acridin yellow .....	Blue, violet and ultra-violet.
Eosin (yellow) .....	Green, blue, violet and ultra-violet.
Eosin (blue) .....	Green and blue.
Tropæolin, O. O. O.	Green, blue and violet.
Orange G. ....	Blue-green, blue and violet.
Coccinin .....	Yellow-green, blue-green, blue, violet and ultra-violet.
Ponceau .....	Yellow-green, blue-green, blue, violet and ultra-violet.
Biebrich scarlet .....	Yellow-green, blue-green, blue, violet and ultra-violet.
Saffronin .....	Greens and blue.
Brasillin .....	Yellow-green, blue-green and blue.
Ruthenium red .....	Yellow-green, blue-green and blue.
Bordeaux red .....	Yellow-green, blue-green and blue.
Magenta .....	Yellow-green, blue-green and blue.
Erythrosin .....	Yellow-green, blue-green and blue.

## 2 ISOCHROMATIC PHOTOGRAPHY.

Dye.	Absorption.
Sudan III .....	Yellow-green, blue-green and blue.
Crocin .....	Yellow-green, blue-green, blue and violet.
Ammonium picrate ..	Blue, violet and ultra-violet.
Emerald green .....	Orange and violet.
Malachite green ....	Orange and violet.
Solid green .....	Orange and violet.
Anilin green .....	Orange and violet.
Iodine green .....	Red, orange, blue and violet.
Naphthol green .....	Orange and violet.
Light green S. F....	Orange and violet.
Fast olive green ....	Orange, yellow and violet.
Fast green .....	Orange, yellow and green.
Nile blue .....	Orange, yellow and green.
Methylen blue .....	Orange, yellow and green.
Methyl violet .....	Orange, yellow and green.
Formyl violet .....	Orange, yellow and green.
Crystal violet .....	Orange, yellow and green.
Hofmann's violet ...	Orange, yellow and green.

A very convenient method of manufacturing a variety of screens suitable for use with the various plates upon the market is to coat thin sheets of Russian mica (which must be free from blemish) with a stained collodion. I have found this method very useful in work where a filter with a special action was desired for some particular plate or purpose. This stained mica may be used before, behind or between the combinations of the lens, and one or more sheets may be introduced, at the will of the operator.

The mica should be selected of as thin a quality as is consistent with safe handling, and special care must be taken that no finger-marks appear on either surface. It is then cut up into pieces somewhat larger than the screen desired and flowed over with a collodion made as follows:

Gun cotton (Anthony's snowy)...	10 grains
Alcohol .....	1 ounce
Ether .....	1 ounce
Dye stuff (about).....	2 grains

The dye should first be dissolved in the alcohol and the cotton then added. After standing for a few minutes the ether is added and the mixture shaken.

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until the cotton is entirely dissolved, and then carefully filtered. The piece of mica is then edged with a solution of rubber in benzol (which dries almost immediately) placed upon a small piece of glass to give stability during the operation, flowed over with the stained collodion (only practice will give skill in this operation, but it presents no difficulties worth speaking of), gradually brought to a vertical position with a constant rocking semi-circular movement to avoid the collodion forming "waves," and when set reared on end to dry. Several such screens may be made by selecting any dye from the foregoing list which will fulfill the necessary requirement of the conditions, or two or more differently stained sheets may be combined, as before stated. There is a slight loss of illumination in the absorption of the mica, but it is so small that it can be overlooked. Any number can be carried into the field or from place to place between the leaves of a note-book. For screens of a lighter color dilute the collodion with equal proportions of ether and alcohol in varying amounts.

It is impossible to give any more detailed instruction for manufacture without needless repetition of what has already been said, for if the earlier chapters have been seriously and carefully read they contain in themselves all the necessary information. First know what you are striving for — what color you want to cut out, or dim down, and then turn to the table of dyestuffs and select the color.

In selecting a number of dyes for combination it is not sufficient that they give only the correct absorption; they must also pass without obstruction the rays that are desired. For example, suppose that it is required to cut off the yellow and the violet. A solution of chrysoidin and china-blue will do it, but a solution of methyl-blue and picric acid will do it better, for the first combination not only cuts off the undesirable hues but also slightly dims down the luminosity of the greens, and it is for the determination of this latter point that the small prism (H, Fig. 2) is added. In use two equally luminous flames are used, one in front of the slit plate and the other at one side and carefully adjusted for distance until upon

looking into the telescope the two spectra are seen, the one above the other, exactly coincident in luminosity, then the two solutions to be compared are placed one in front of each light, and the comparative absorption is seen at a glance.

Although no really good or complete work in isochromatics can be performed without the aid of the spectroscope, yet visual observation of the spectrum is not enough, for the ultra-violet rays which are the most energetic in actinic effect are altogether invisible. For example: A solution or screen of chrysoidin yellow appears to cut off the spectrum in the blue, and to totally absorb everything beyond, but a photograph taken through the same screen will show a strong action in the ultra-violet; hence the necessity for a photographic test before making a deduction.

It is only a question of a very short time when the American plate manufacturer will awake to the importance of following in the footsteps of his European brother, and make a filter and safe light suited to his own particular plate. The great army of photographers are becoming better educated in this line

with the passing of each year, until now the number of serious workers forms one vast concourse, which is just beginning to shake off the lethargy induced by "old-fashioned" text-books that, in many cases, still obtain as "standards." Photographers are even now looking askance at many of the so-called isochromatic effects—a sure evidence of a higher education. But platemakers, like any other body of men, dislike a radical change, for it is so much easier to travel along in the rut worn smooth by usage than to make the effort to climb the side and "blaze" a new path, forgetful of the fact that a new path, if scientifically correct, will redound eventually both to the honor and profit of the manufacturer.

In these chapters much detail work has, of necessity, been omitted, but all salient points have been touched upon more or less fully, and the writer will be amply repaid if they are conducive in even a feeble way to the better understanding of the subject, and hasten the time by even a fraction when the photographic world will be educated up to and demand an isochromatic plate and filter that is truly isochromatic, and will not



be satisfied with any makeshift, however cheap or handy.

The writer is pleased to note that an absolute adjusted filter has been placed upon the market for both the Cramer and Seed Isochromatic plates. While Carbutt's filter is in many ways good for his polychromatic plate, yet in the hands of the author it has shown decided lack of adjustment, being over-corrected for the reds.

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NOTE.— Since writing the above the author has been led to the conclusion that although the collodion methods serve very well for the manufacture of light filters which are not required to retain their permanency through a number of years, yet the use of gelatin as a coating upon the glass is much to be preferred, as offering results which are to the best of his observation *strictly* permanent. After the lapse of a few years the collodion film is apt to show irregular opalescence (like ground glass), which interferes greatly with its working — in fact, it will, as it increases, render the screen entirely useless.

Under his continued observation for

a period of about eight or ten years, this defect has not shown itself with gelatin, therefore, for very careful work, the remedy is obvious.

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